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ABSTRACT

The 1980 CAUSE conference focused on how the management information systems area can add to the efficiency and effectiveness of the higher education institution. After acknowledgements and brief notes on general session topics, the papers are presented in six groups: (1) issues in higher education (futures planning, strategic decision-making, and resource allocation for computer support in two-year colleges); (2) managing the information systems resource (computer personnel retention, legal protection, catastrophic events and contingency planning, buying vs. making software, systems development, political influences); (3) the emerging technology (distributed processing, automatic speech recognition, the paperless office, world knowledge systems, word processing and document production, database management, videodisc); (4) trend and market analysis to impact analysis (continuing education trends, statistical decomposition, vertical information systems, environmental management and retention, long-range data processing, integrating institutional systems); (5) great applications (Stanford's Terminals for Managers program, registration productivity, student records, distributed continuous registration, experiential based transcripts, on-line transcripts); and (6) vendor presentations. (MSE)

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CAUSE

Productivity — A Key to Survival in the 1980's

Proceedings of the 1980 CAUSE National Conference

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Phoenix, Arizona
December 7-10, 1980

Productivity — A Key to Survival in the 1980's

Proceedings of the
1980 CAUSE National Conference

December 1980
Phoenix, Arizona

Edited by
Patricia C. Skarulis
and
Charles R. Thomas

737 Twenty-Ninth Street, Boulder, Colorado 80303 (303) 449-4430

INTRODUCTION

The 1980's will be a difficult decade for all of higher education. With declining enrollment, continuing inflation, soaring energy costs, increasing government regulation and decreasing revenue sources, colleges and universities must continue to improve productivity and reap maximum benefits from limited resources.

The theme for this year's conference was "Productivity — A Key to Survival in the 1980's," and more specifically, how the information systems area can add to the efficiency and effectiveness of the institution. The individual track themes supported the Conference theme. In order to provide the necessary leadership for information systems development in the next decade, we must understand the major issues facing higher education, and Track I: Issues in Higher Education addressed some of these important issues. As managers of the information systems area, we must be concerned with the productivity of our own department, and Track II: Managing the Information Systems Resource addressed topics in this area. Since new technological developments may yield some hopes for productivity increases, Track III: The Emerging Technology presented some of the newer technology. Track IV: Trend and Market Analysis to Impact Analysis addressed the ways information systems can enhance the effectiveness of the institution. Track V: Great Applications featured applications that have significantly increased productivity for user departments.

The 1980 CAUSE National Conference included several general sessions, five tracks of concurrent sessions, vendor presentations, and a forum for topics of special interest to the attendees.

We hope these Proceedings will provide a continuing reference to the many activities of the Conference and the CAUSE organization. We also hope you will benefit from sharing the experiences of others and thus become more effective in the development, use and management of information systems at your institution.

We encourage you to utilize CAUSE to complement your individual efforts at strengthening your organization's management capabilities through improved information systems.

CAUSE, the Professional Association for Development, Use and Management of Information Systems in Higher Education, helps member institutions strengthen their management capabilities through improved information systems.

Formerly known as the College and University Systems Exchange, CAUSE first organized as a volunteer association in 1962 and incorporated in 1971 with 25 charter member institutions. That same year the CAUSE National Office opened in Boulder, Colorado with a professional staff to serve the membership. Today the organization has 350 member institutions with 1,300 member representatives and continues to grow.

CAUSE provides member institutions with many services to increase the effectiveness of their administrative information systems: organization publications such as a magazine, newsletter, and monograph series, the CAUSE Directory and the Conference Proceedings; a Professional Development Program offering workshops and seminars on subjects related to information systems in higher education; consulting services to review ADP organizations and management plans; the Exchange Library to provide a clearinghouse for non-proprietary information systems contributed by members; and an Information Request Service to locate specific systems or information.

The CAUSE National Conference is an excellent forum for the exchange of ideas, systems and experiences among the many speakers and participants. The Proceedings provide a continuing reference to the many activities of the Conference.

Patricia C. Skarulis
1980 Conference
Chairman

R. Brian Walsh
1980 Conference
Vice-Chairman

Charles R. Thomas
Executive Director
CAUSE

ACKNOWLEDGEMENTS

The success of the CAUSE National Conference is due entirely to the contributions of people and supporting organizations. Although it would be impossible to identify all of the people who contributed time and effort to the planning and operation of the 1980 Conference, several deserve special note.

The Program Committee, with the CAUSE Staff, spent many hours to produce an effective and smoothly run conference. Their enthusiasm, efforts and the support of their institutions are gratefully acknowledged.

1980 CAUSE NATIONAL CONFERENCE PROGRAM COMMITTEE

Seated from left to right: Jane Knight, CAUSE; Nellie Hardy, University of Arkansas at Pine Bluff; Marilyn McCoy, NCHEMS; Deborah K. Smith, CAUSE. Standing from left to right: M. Lloyd Edwards, Emporia State University; Richard L. Mann, University of Kansas; Patricia C. Skarulis, Princeton University; R. Brian Walsh, University of Notre Dame; Warren H. Groff, North Central Technical College; Charles R. Thomas, CAUSE. (Not Pictured) Maurice Arth, Cuyahoga Community College; Connie McNeill, Arizona State University; Martin B. Solomon, University of Kentucky.

The logistics of conference registration were efficiently supervised by Ms. Jane Knight of the CAUSE Staff with the assistance of Ms. Verna Mae Campbell and Ms. Cathie Reiland both of Arizona State University. Their efforts and friendly smiles are appreciated.

The advance preparation for the Conference and the publication of the proceedings require a great deal of professional expertise and effort. The contributions of Mr. Robert Byrd, Mrs. Julia A. Rudy and Mrs. Deborah K. Smith of the CAUSE Staff are sincerely appreciated.

The continuing support of the CAUSE Board of Directors and the membership they represent is also gratefully acknowledged.

1980 CAUSE BOARD OF DIRECTORS

Seated from left to right: Charles R. Thomas, CAUSE; Mary Jo Caster, University of Cincinnati; Joseph A. Catrambone, University of Illinois; Dewana P. Green, University of Alabama; Ronald J. Langley, University of California. Standing from left to right: Wm. Mack Usher, Oklahoma State University; Gary D. Devine, University of Colorado; Wade Harris, Eastern Washington University; Charles A. Brooks, South Carolina Commission on Higher Education; R. Brian Walsh, University of Notre Dame; Vinod Chachra, Virginia Tech.

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GENERAL SESSIONS

CAUSE 80 was highlighted by a number of special General Sessions which brought conferees together periodically throughout the Conference to hear presentations on subjects of broad interest and concern to all. This year's Conference featured the first CAUSE Recognition Luncheon, where recipients of the CAUSE Recognition Awards were honored, as well as awards presented to the 1980 CAUSE National Conference Program Committee and others in the organization for their service to CAUSE in the past year.

WELCOME/KEYNOTE ADDRESS

CONFERENCE WELCOME

Paul A. Elsner, Chancellor of the Maricopa County Community College District, welcomed the CAUSE 1980 National Conference to Phoenix, and shared his views on the important issues that information systems professionals might consider while attending the Conference.

Paul A. Elsner
Chancellor
Maricopa County
Community College District

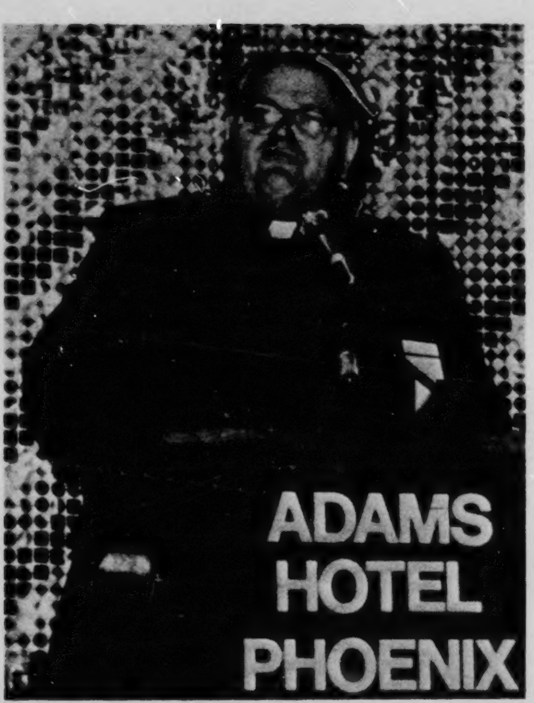
Herbert Halbrecht
Halbrecht Associates, Inc.

KEYNOTE ADDRESS

HERBERT HALBRECHT—ON PERSONNEL

Herbert Halbrecht provided the keynote address for the Conference and identified one of the major problems facing information systems in higher education in the 1980's, the projected shortage of qualified MIS professionals. Mr. Halbrecht outlined ways colleges and universities can be most effective in recruiting, selecting and retaining such professionals in spite of the anticipated shortage.

DOES IVY GROW ON YOUR COMPUTER?



Reverend David M. Clarke, S.J.
President
Regis College

LUNCHEON ADDRESS

Reverend Clarke delivered an inspiring presentation on college and university excellence and the role that information systems professionals can and must play in order to help their schools achieve greatness.

R. Brian Walsh and Reverend Clarke

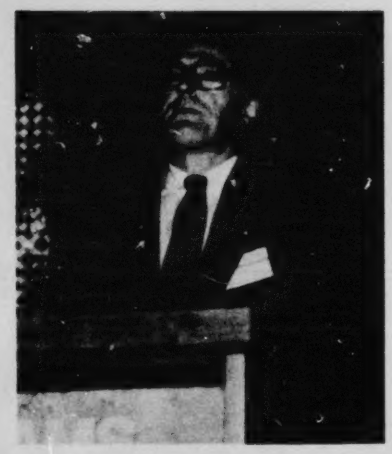
MAN AND THE COSMOS

B. Gentry Lee
Project Engineer
Project Galileo

TUESDAY MORNING ADDRESS

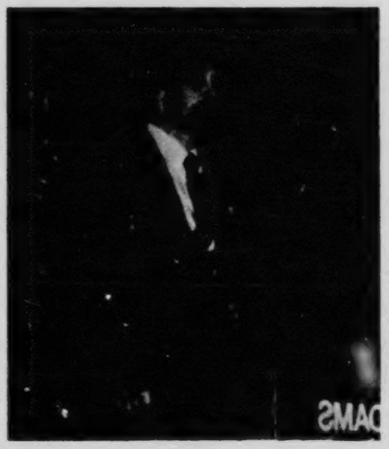
B. Gentry Lee delighted conferees with his stimulating ideas on man and the cosmos, as well as his entertaining and enlightening voyage-through-space slide and film presentation.

EDUCATION FOR WHAT?
A DEBATE



Reid Buckley
World Traveler and Adventurer

Wednesday Closing Session



Nicholas Johnson
National Citizens' Committee
for Broadcasting

DAMS
HOTEL
PHOENIX

Pat Skarulis and Reid Buckley

The Conference closed on a spirited note with an exciting debate between Reid Buckley, proponent of the classics, and Nicholas Johnson, proponent of technology. Mr. Buckley and Mr. Johnson waged an articulate verbal battle about the place of values in education today.

RECOGNITION LUNCHEON

Program Chairman Patricia Skarulis presented tokens of appreciation to members of the 1980 Program Committee and Registration Staff. CAUSE President Joseph Catrambone presented the first annual CAUSE Recognition Awards to Ronald Brady and Michael Roberts for exemplary leadership and professional excellence, respectively. President Catrambone also introduced the three new members of the CAUSE Board of Directors and the new CAUSE officers. Retiring Board members were awarded Certificates of Appreciation.

Outgoing CAUSE President Joseph A. Catrambone presents the gavel to newly-elected President Dewana Green.

1981 CAUSE President Dewana Green presents outgoing President Joseph A. Catrambone the President's Plaque.

CAUSE 80 Chairman Patricia C. Skarulis displays her gift of appreciation from CAUSE as Vice Chairman R. Brian Walsh shows his approval.

RECOGNITION PROGRAM

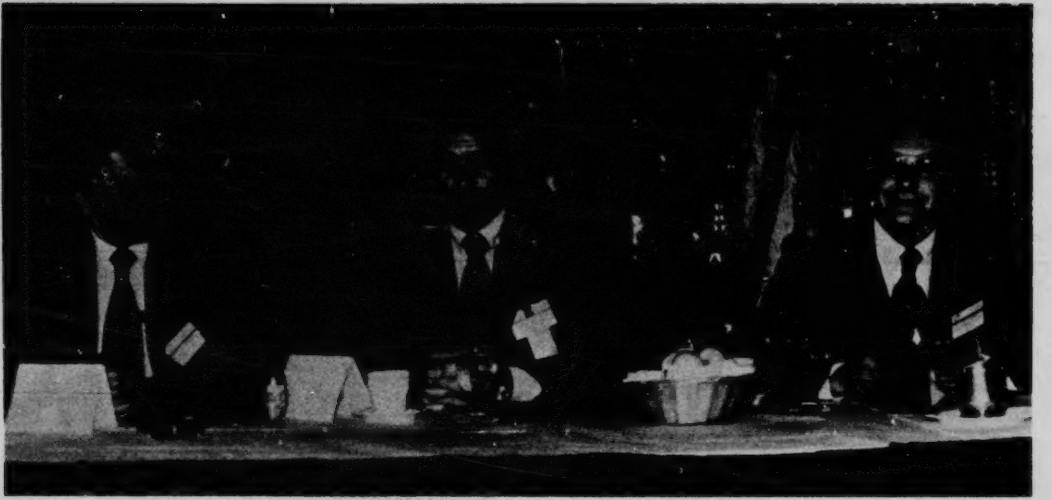
President Catrambone presents Ronald W. Brady, University of Illinois, the first CAUSE Award for Exemplary Leadership for his advocacy and support of administrative information systems in higher education at his university and at the national level.

President Catrambone presents Michael M. Roberts, Stanford University, the CAUSE Award for Professional Excellence in the field of administrative information systems in higher education at his university and at the national level.

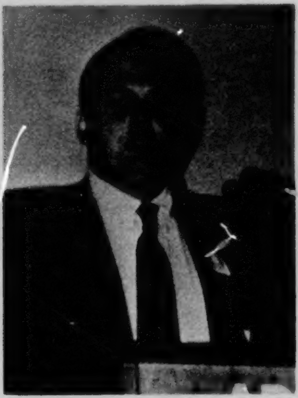
AWARDS

R. Brian Walsh presents a certificate of appreciation to Norward Brooks, University of Washington, for his service on the Election Committee.

Patricia Skarulis presents Track VI Coordinator Maurice P. Arth his gift of appreciation.

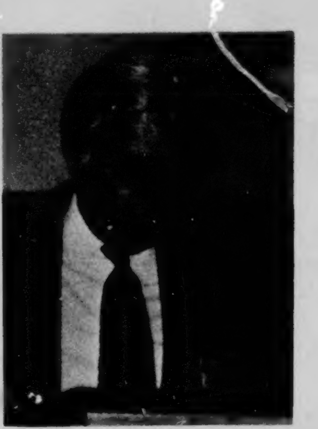


New members of the CAUSE Board of Directors, from left to right: William Walden, University of New Mexico; Jerry Magnuson, University of Kansas; and Robert Sanders, Community College of Denver.



R. Brian Walsh

Retiring Board Members



William Mack Usher

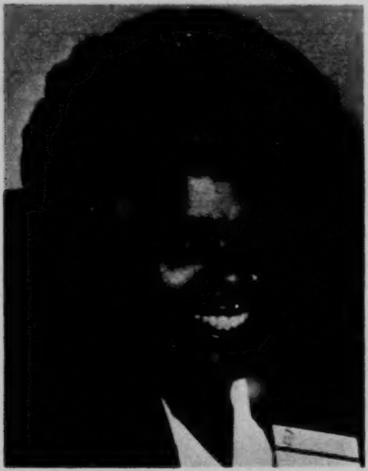
President Catrambone congratulates Maureen Murphy (left) and Laura Nell Gasaway for their newly published book Legal Protection for Computer Programs, the first CAUSE monograph.

PROFESSIONAL PRESENTATIONS

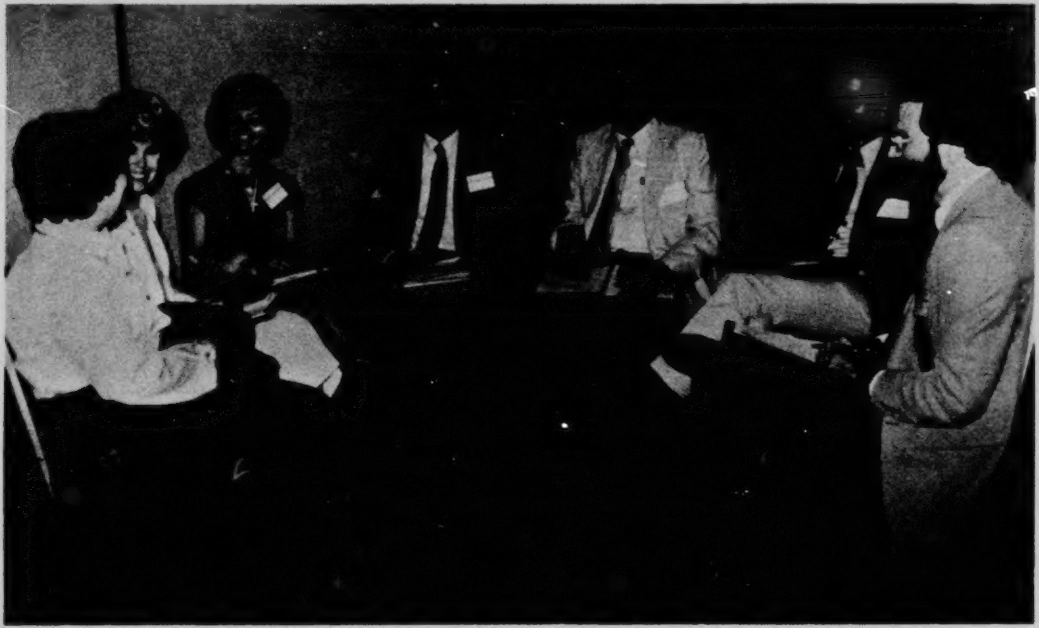
The CAUSE 80 Conference theme was addressed through 40 presentations in five subject tracks (see Table of Contents) as well as a dozen vendor presentations and Special Interest Sessions.

SPECIAL INTEREST SESSIONS

Coordinator:
Nellie Hardy
University of Arkansas



Special Interest Sessions were scheduled in eight areas and took the form of small, round-table discussion groups. Conferees had the opportunity to meet informally with others who had similar interests, either to ask for help or share a successful experience with respect to the topic under discussion.

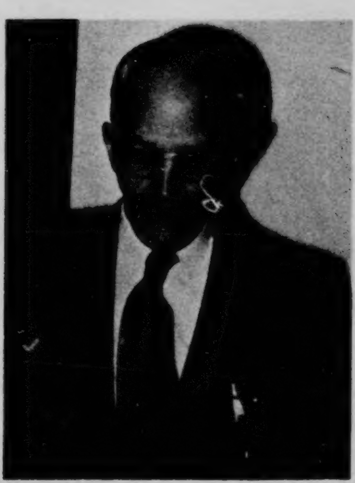


TRACK I
ISSUES IN HIGHER EDUCATION

Coordinator:
Marilyn McCoy
NCHEMS, Colorado

Judith W. Leslie
Pima Community College

Warren H. Groff
North Central Technical College



Maurice P. Arth
Cuyahoga Community College

As the Third Wave Approaches Higher Education: Planning for the Electronic Institution

Judith W. Leslie
Pima Community College
Tucson, Arizona

The purpose of this paper is to provide a framework and a derivative course of action to higher education institutions as they move through transition from an industrial to technological society. The concept of equilibrium/disequilibrium is the theoretical basis of the framework. The application of the concept is demonstrated in three successive models. Each model incorporates the social, political, and economic forces that operate on an institution as manifest in the functions of instruction and instructional support, student services, and institutional support. The paper concludes with seven recommendations to ease the transition to technology.

Introduction

"Did we come here to laugh or cry?
Are we dying or being born?"

Terra Nostra by Carlos Fuentes

Alvin Toffler cites this quotation as he introduces his recent book, The Third Wave. In response to the questions posed in this quotation, the reader is led into the pages that follow in search of answers. To provide clues, Toffler describes periods of society using the analogy of waves as indicators of societal change. He describes the First Wave as bringing about an agricultural society; the Second, an industrial society; and the Third Wave bringing on a technological society. To understand why the questions in the quotation were posed in relation to the three waves, Toffler elaborates on the turbulence created as one wave rolls in and another recedes. The following excerpt illustrates this turbulence as the Third Wave, technology, approaches.

> "A new civilization is emerging in our lives and blind men everywhere are trying to suppress it. This new civilization brings with it new family styles; changed ways of working, loving, and living; a new economy; new political conflicts; and beyond all this an altered consciousness as well. Pieces of this new civilization exist today. Millions are already attuning their lives to the rhythms of tomorrow. Others, terrified of the future, are engaged in a desperate, futile flight into the past and are trying to restore the dying world that gave them birth."[1]

The focus of this paper will be upon the effects of the Third Wave as it approaches the societal institution of education, specifically higher education. The questions Toffler posed of society in general also can be asked of higher education in particular: to reiterate, did we come here to laugh or cry, are we dying or being born? As to what answers may be given, one may look to the recent final report of the Carnegie Council which suggests that in higher education there will be three thousand futures. Inferring from the Council's report, one can assume that there will be a continuum ranging from birth to death as each institution struggles to cope with and adapt to the technological society of the future.

As background to the discussion of the effects of the Third Wave, a brief description will be presented of the past, First and Second Wave societies and the future, Third Wave society, according to Toffler. A theoretical framework then will be constructed in successive steps. Common elements in each step will include the societal forces of a social, political, and economic nature as they affect the institutional functions of instruction and instructional support, student services, and institutional support. Based upon the framework, the discussion will conclude with a set of recommendations for use in long range institutional planning. The purpose of the paper is to provide a framework and a derivative course of action to enable institutions of higher education to move smoothly through the transition from a Second to Third Wave society; away from death and toward rebirth.

---

[1] Toffler, Alvin, The Third Wave, William Morrow and Co., Publishers, 1980, p.25.

Background

As noted above, the background to the theoretical framework entails an overview of two past and a future society, whose advent Toffler calls waves. As part of the overview, the social, political and economic forces operating within each society will be highlighted. Subsequently, this information will be incorporated into the theoretical framework.

First Wave - Agricultural

Toffler describes the advent of the first wave as follows:

> "Before the first wave of change, most humans lived in small, often migratory groups and fed themselves by foraging, fishing, hunting, or herding. At some point, roughly ten millenia ago, the agricultural revolution began and it crept slowly across the planet spreading villages, settlements, cultivated land, and a new way of life."[2]

Social Forces. At the base of social forces are the values of a society. In agricultural society, land was the predominant value. People lived in small, scattered villages. Although family forms varied, most lived in large, multi-generational households.

Political Forces. Political forces in the agricultural society were manifest in rigidly authoritarian structures. A simple division of labor prevailed. A few clearly defined castes and classes emerged as evidenced by the existence of a nobility, a priesthood, warriors, slaves, and serfs. In all of these, birth determined one's position in life.

Economic Forces. The most obvious economic force of this time was manifest in the phenomenon of producer as consumer. To explain, most individuals (or groups of individuals within a small community) produced all that they consumed. Toffler refers to this economic phenomenon as a "prosumer" economy, the blending of both producer and consumer into one. Eventually this and other forces changed and a new society emerged.

Second Wave - Industrial

Toffler estimates that industrial society began about 1650-1750 and ended by 1955. He identifies six underlying principles of this society: standardization, specialization, synchronization, concentration, maximization, and centralization. These principles become evident within the social, political, and economic forces of the time.

[2] Op Cit, p.29.

Social Forces. One of the fundamental changes brought about by industrial society was the change in family structure. Rather than large, multi-generational households characteristic of agricultural society, families became what Toffler calls, "streamlined," in industrial society. Another descriptor is "nuclear" or two-generational. Grandparents were relegated to nursing homes, and other relatives were left behind as families moved to urban centers in search of work in the factory.

Political Forces. The factory served as a political model in industrial society. Its division of labor, hierarchical structure, and metallic personality were incorporated into other major organizations of the time such as schools, hospitals, and government. Democracy flourished with its representational form of government. Despite such representation, however, power was centralized throughout all political structures of industrial society.

Economic Forces. Toffler describes the primary economic force of this period as the "invisible wedge." He describes this wedge as follows:

> "Instead of essentially self sufficient people and communities, the Second Wave created for the first time in history a situation in which the overwhelming bulk of all food, goods, and services was destined for sale, barter, or exchange... Everyone became almost totally dependent upon food, goods, and services produced by someone else."[3]

Thus, the marketplace flourished in and became integral to industrial society. Like agricultural society, this industrial society crested, and a new wave rolled in.

Third Wave - Technological Society

The Third Wave is anticipated to bring about an anti-industrial society -- one that is instead, highly technical. Toffler foresees that this wave will sweep across history and complete itself within the next few decades. With it, however, a new way of life is expected to emerge.

Social Forces. One aspect of this new way of life is envisioned to be the change in family structure and role. Toffler foresees an electronically expanded family which would include relatives, friends, and colleagues in a "family cooperative." This cooperative, in turn, would operate like a small business, based primarily in the home or, what Toffler calls, the "electronic cottage." Family members would share and exchange workloads; all would contribute to production in some form. Because technology provides locational flexibility, Toffler expects families and businesses to decentralize, moving away from urban centers and into smaller, rural communities.

Political Forces. Toffler identifies several principles that he predicts will underlie the political structure of the future. The first is minority power which would be evidenced in a demassified society. The second

[3] Op Cit, p.55

is semi-direct democracy which, translated into practice, would mean representing oneself. The third, and to Toffler vital, principle is "decision-division." He predicts a break-up of the decisional logjam, with the result being that decisions would be allocated to the level or levels where they most appropriately belong. He suggests that decisions would be divided up, shared more widely, and switched to the site of decision making as the problems themselves require.

Economic Forces. Characterizing the economy of the Third Wave requires that the economies of the First and Second Waves be reiterated briefly. The First Wave economy was described by Toffler as sector A dominated; consumer/producer as one. The Second Wave economy was portrayed as sector B dominated: the separation of consumer and producer. Looking ahead, Toffler predicts the Third Wave economy will be a balancing of sector A and sector B. This would mean that the producer would consume both the goods and services he/she produced and those produced by another. Toffler arrives at this prediction based upon a number of factors such as increased leisure time, cost/benefit, and personal satisfaction.

To summarize the background information, the following generalizations are made. The First Wave is characterized by a multi-generational family, an authoritarian political structure, and a prosumer economy. The Second Wave is characterized by a nuclear, two-generational family, a representative and hierarchical political structure, and a split producer/consumer economy. The Third Wave is envisioned to be based upon an electronically expanded family, a demassified political structure, and a balanced producer/consumer economy. Drawing upon this information, the discussion turns now to the theoretical framework.

Theoretical Framework

As noted in the introduction, the theoretical framework is constructed in successive steps; each step is captured in a model. Three models are presented, each containing the following elements: societal forces - social, political, and economic; and institutional functions - instruction and instructional support, student services, and institutional support. For purposes of this paper the following definitions are employed:

Instruction and Instructional Support - The methodology by which knowledge and skills are transferred to and acquired by a learner and a given course or program of study;

Student Services - Services provided to students to assist them in enrolling and completing a course or program of study;

Institutional Support - Services rendered by management and their respective staffs to conduct the on-going operation of the institution.

The theoretical basis of the models is derived from the work of Jean Piaget and J. McVicker Hunter, learning theorists. Inferring from their work, in the learning process individuals encounter periods of "equilibrium" and "disequilibrium." A state of equilibrium is reached when mastery is achieved. A state of disequilibrium prevails when an individual is presented with a new skill and continues until he/she masters the new skill. Within the state of disequilibrium, there are two reactions. The first is motivation. This occurs when skills previously acquired are sufficient to master new skills. The second reaction within a state of disequilibrium is frustration. This is brought about when previously acquired skills are insufficient to master new skills.

For purposes of this paper, equilibrium will refer to that state in which society is in harmony: for example, in an agricultural or industrial period. Disequilibrium will refer to three phenomena. The first occurs when society is in transition from one period to another: for example, from industrial to technological. The second prevails when an institution does not reflect the predominant societal period; and the third takes place, within an institution, when various functions differ in what societal period they reflect. This theory is now set forth in the successive models to follow.

Application

Model One

Model One portrays a higher education institution in equilibrium. The institution reflects society's social, political, and economic forces through the functions of the institution. To illustrate, a hypothetical description of an industrial institution in an industrial society is given (See Figure One).

Within the function of instruction, a traditional core curriculum would be required. Classes would start and stop at a specific time on a given day during a set academic period. Instructors would use a lecture/recitation methodology, like the one to which they were accustomed as a student. The primary medium of instruction would be books. These books would be checked out of a monolithic library and a fine would be assessed if the books were returned late. Large lecture halls would be evident in many buildings. Decision-making would occur in an hierarchical process from the faculty to the department chairman, on to the dean, for review by the vice president, and then decision by the president. Faculty would be represented by a senate. Allocations would be made for new faculty and staff positions and new facilities. Counseling would be on a one-to-one basis and to register, students would stand in long lines. The administration would consist of white males supported by large numbers of female clerical staff. The organizational structure would reflect line and staff responsibilities. The work week would be forty hours, from eight to five with an hour for lunch. In sum, a synchronized, specialized, and centralized institution. But, as Toffler so descriptively points out, society is not in equilibrium, but disequilibrium. A second model, therefore, is constructed to depict disequilibrium.

Model Two

This model depicts Model One in a three dimensional format, extending it along a continuum which represents the period of transition between the past industrial society and the future technological one (See Figure Two). The social, political, and economic forces of Model One are modified in Model Two to reflect direction toward or away from either the industrial or technological society. Three institutions are imposed upon the continuum, using a plane format in which the three functions of instruction and instructional support, student services and institutional support are delineated. Institution A is industrially dominated, similar to the institution described in Model One; Institution C is technologically dominated; and Institution B is a mixture of both industry and technology. A description of Institution C follows to illustrate the gap in which Institution B finds itself.

Instruction in Institution C would be technologically oriented, carried out primarily through electronic media. This methodology would allow the learner to proceed at his/her own rate and style, within his/her own time period, at his/her desired location, drawing upon learning materials from throughout the country and world. Computer science and electronics courses and programs of study would be an integral part of the curriculum. Faculty would be cross-trained in a variety of disciplines and teaching styles. They would have flexible work schedules and loads and may share an assignment with a spouse or colleague. Many faculty would instruct from their home or electronic cottage, sometimes located away from the urban center in which the institution is located. As to campus facilities for instruction, many would have been sold or used for other purposes; some would have been renovated to accommodate new electronic hardware. Libraries would be scaled down and converted to laboratories. Most holdings would decline as technology allows for communication with major libraries and sources of information. A student would check out a computer, not a book (and would not be fined, if late). Faculty and students would participate in governance, representing themselves directly at the level on which the decision would be made. In recent years personnel costs would have shown a steady or decreasing trend. Capital appropriations would have been allocated to hardware and software rather than new instructional facilities.

The instructional support function also would be carried out primarily via electronics. Fewer counselors would serve more students, capitalizing on the interactive and flexible capability possible with electronics. Registration would be done from a student's home or workplace.

Within institutional support, managers would conduct their day to day business with minimal, if any, paper. The size of support staff would have been decreased and,more importantly, the nature of their work would have been upgraded. Many would work at home with flexible schedules and workloads. Decisions would be backed by a sophisticated data base from which administrators could draw at any time. Political considerations would be known as interactive, direct participation would be available via technology. Decision-making would be allocated to the most appropriate level. The Computer Center would be organizationally linked to all components of the institution. Finally, expenditures would be devoted increasingly toward a capital rather than labor-intensive work force.

As with the description of Institution A, this portrayal provides only a sample of characteristics that are likely to be evident in an institution.

To complete Model Two, a discussion is in order of possible social, political, and economic forces that push and pull institutions along the continuum between industrial and technological society.

Forces Preserving an Industrial Institution

Values of industrial society are evident today in the attitudes of many parents, faculty, and administrators. The call from parents for back-to-basics frequently means back to traditional modes of instruction. Many faculty, too, hold to industrial values; they adhere to the traditional mode in which they were trained and only reluctantly deviate from this norm. Some administrators also preserve industrial values. Commonly, their families resemble the nuclear family of industrial society and deviations from this style are not accommodated. Further, administrators are cautious about deviating from what is acceptable within a bureaucratic structure.

Political forces of industrial society are deeply embedded in higher education. There is evidence of strong resistance on the part of some faculty, staff, and administrators to alter the organizational structure and patterns of governance. Faculty and staff unions have established themselves in higher education. This representational form of decision-making is consistent with an industrial rather than technological society. Governmental bodies adhere to many of the industrial principles. This is evident in recent legislation and coordinating bodies established to standardize, synchronize, and centralize higher education. It should be noted that these Second Wave principles have impacted higher education only more recently and may not, therefore, have crested. Consequently, as the Third Wave approaches, the disequilibrium created in higher education undoubtedly will be substantial.

Economic forces preserving industrial society also are evident. Stemming from political forces, many institutions are "locked in" to long term cumulative personnel costs due to policies and contracts with faculty and staff. Also, the growth in campus facilities during the sixties, has resulted in a sizable institutional investment in plant maintenance and operation. Because of these commitments, few resources are available to acquire the new technology.

Forces Moving Institutions Toward Technology

A number of social forces are coming to bear on higher education institutions that will push institutions toward technology. The first pertains to enrollment projections. As the Carnegie Council reports, enrollments are projected to decline through 1997, and not recover to 1983 levels until 2010.[4] Equally important is the composition of those who are expected to attend higher education. More than half (52%) are anticipated to be women, one quarter (25%) minorities, and close to one half (45%) are expected to be part-time students. Also of interest is that 41% are projected to enroll in two year institutions, 85% are estimated to be commuters, and 50% are expected to be in the over age 22 age group.[5] These changes in numbers and composition will have a profound influence in bringing about a technological institution. To explain, knowing that more than one half are projected to be women implies that greater flexibility and more convenience will be necessary. The proportion of expected minorities also suggests that supportive services need to be available, one of the more promising being electronically based instruction. The same need for flexibility and convenience needed by women also will be necessary for the sizable portion of part-time students who are expected to enroll. The overwhelming number of commuters will bring pressure for alternatives to alleviate the increasing costs of transportation. The heterogeneous composition of future students strongly suggests that a number of learning modes are necessary, many of which could be electronically based. All enrollment indicators, therefore, suggest a departure from the industrial principles of standardization, synchronization, concentration, maximization, and centralization.

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[4] Final Report the Carnegie Council on Policy Studies in Higher Education, Three Thousand Futures: the Next Twenty Years of Higher Education, Jossey Bass, Inc., Publishers, 1980, p.47.

Political forces in favor of a technological institution are beginning to emerge. Minorities have, over the last two decades, exerted considerable political pressure as evidenced in federal legislation. The impact of this legislation provides many examples of minority power, or a demassified society, as Toffler envisions in technological society.

Economic forces, however, may be the single most important factor in bringing about a technological institution -- and it may be due largely to enrollments -- a social force. Because most institutions receive allocations based upon enrollment-driven formulae, a decline in enrollments means a decline in revenue. To address this problem, institutions increasingly are broadening their market and recruiting non-traditional students. Many institutions, in doing so, are using electronics as a medium of attracting new students. Further, because of the flexibility technology offers, institutions are acquiring hardware to retain these students. As institutions are able to increase enrollments, revenues correspondingly will increase. Another economic consideration is the mushrooming cost of maintaining facilities. Energy costs, labor costs, and regulation all add to the large overhead. Technology offers the home, the workplace, a shopping center, or other less costly facilities. An institution's operating budget has less and less flexibility due to built-in rising personnel costs. Technology offers an alternative. As offices acquire hardware and software to perform routine duties formerly done manually by large support staffs, attrition and/or retrenchment become more feasible. Finally, and perhaps most importantly, the cost of technology is declining; it is fast approaching the point at which the majority of homes will have a computer. As this comes about, individuals will experience the benefits, develop an appreciation of worth, and ultimately integrate technology into their value structure. Once this takes place, political forces in support of technology will begin to operate.

Thus, in the years ahead, there is a strong possibility that the forces in favor of a technological society will become much stronger than the forces holding to an industrial society. As this movement relates to Model Two, Institutions A, B, and C will be pushed along the continuum toward a technological society. Institution A will have a much larger span to cross than would Institution B, and especially C. As this movement relates to the theory of equilibrium/disequilibrium, the span may be too large for Institution A to bridge--frustration may result. For Institution C, however, movement to a technological society will require bridging only a small distance on the continuum. According to the theoretical base, this change would create a state of motivation. The question now becomes Institution B. Is the span so large that a state of frustration will result or is it small enough for motivation to ensue?

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[5] Op Cit, p.53.

Model Three

To address this question, Model Three is proposed. This model also uses the continuum from industrial to technological society. The three societal forces are present, too, but reformatted into a wheel. This change is made in recognition of the interactive rather than parallel nature of societal forces. Institution B from Model Two has changed considerably when placed in Model Three. No longer a plane, Institution B has taken on an irregular configuration, depicting variation among and within the functions of instruction and instructional support, student services, and institutional support.

The theory of disequilibrium is most pronounced in Model Three. Therein, Institution B is in a period of societal disequilibrium. Additionally, the variation of the Institution along the continuum suggests disequilibrium within the Institution. Consequently, Institution B is subject to both external and internal disequilibrium. A description of Institution B follows.

Technology was the focus of Institution B during the formative years as architectural plans were developed to accommodate and support technology. An early change in administration and corresponding educational philosophy, however, resulted in a physical plant similar to most college campuses. Use of technology, though, is evident throughout the Institution today, but in varying degrees. An examination of each function will detail these differences.

The area of student services exhibits the greatest degree of technology and thus is further along the continuum than other functions of the Institution. The reasons for this advancement are several. First, the late sixties movement, which called for greater responsiveness to students, was the period in which the Institution was planned; consequently, political and corresponding economic forces were positive. Faculty and staff hired at that time also valued and recognized the need to respond to students, which added positive social forces to the movement ahead. As hardware was acquired, software was developed to ease students into the system. Eventually, these efforts resulted in a well developed student information system. Students now are able to register on-line; a course repeat module identifies instantly those who are enrolling in repeat courses; and an encumbrance model provides immediate feedback when fees or fines are due. A guidance information system also has been in operation for a number of years, providing career and educational information to students in the institution and surrounding high school districts. Another factor of importance to the advancement of technology in this area has been administrative and staff continuity. The same individuals have served as Registrar and Director of the Computer Center respectively since the initial years of the college; the programmer also has remained constant.

There are forces, though, that are holding this area back, the strongest one being economic. Presently the computer is at capacity, and, if not upgraded, will require that some of the modules be taken off the system. Political forces coincide as resources have been limited by legislative action. This limitation will cause the institution to prioritize. This area may not have political priority in the 1980's. Capital monies are still being allocated to new facilities and, because the institution is ten years old, renovation of existing facilities will become more prevalent in the years ahead.

The discussion turns now to an examination of instruction. Advances are evident in select instructional areas. Political forces exerted the major push which eventually resulted in economic forces coming to bear. To explain, after an in-depth evaluation of the electronics program was conducted, the electronics faculty requested, through their respective administrators, additional positions and hardware. None was forthcoming within the time period desired. Moving out of the Second Wave political structure of representation, to direct representation of the Third Wave, the electronics faculty and students appealed directly to the Governing Board of the institution. This action resulted in pressure being placed on the administration. The next budget reflected several new electronic positions. In fact, of the new faculty positions authorized that year for the institution, the largest number of positions was for either electronics or computer science. Additionally, nearly all capital equipment allocations in the campus budget that year were directed to electronics. Political forces continued to operate, this time initiated by the campus administrator. He served as a key member of the college's long range Master Planning Task Force. Although a number of variables interacted in this process, including community needs and job market, the only programmatic expansion set forth in the Master Plan is in computer science and electronics.

As a methodology, technology is on the increase throughout both transfer and occupational programs. Examples in transfer programs include the use of a micro computer in field work in the Archaeology Department. The Music Department also is relying on the computer in its courses. In occupational programs the computer is used in the Drafting and Nursing Departments. Many other transfer and occupational programs utilize the computer for testing and grading.

Areas in instructional support also are moving toward technology. The Library has a sophisticated circulation module and participates in ERIC and the National Bibliographic Network. Learning laboratories and developmental courses are especially technologically oriented.

There are, however, a number of forces working against the movement toward technology in instruction and instructional support. Some faculty still are reluctant to incorporate technology into the classroom. This attitude was evident at campus hearings of a draft of the Five Year Master Plan in which increased use was suggested. Political negative forces also have had an impact. Within recent years, communication between the Computer Center and the computer science faculty has lessened as campus administration changed and the relationship between the two redefined. Also, changes in organizational structure have limited administrative continuity and political support. Economic forces, however, have been the strongest deterrent. Many faculty have requested computer support but, because the computer is at capacity, some of their requests have not been filled.

The third function, institutional support, exhibits great variability. Political and social forces are largely the cause, given the earlier political priority of student services. Recently, however, political pressures have been mounting to advance institutional support. This pressure surfaces in the form of Governing Board and administrative need for information as part of the decision-making process. New reports are being requested, more frequent reports are called for, and modifications are being made to existing reports. Tracing this need back to its origins, one could identify the social force of accountability closely linked to the economic force of a decline in available resources.

There are forces prevalent in the area of institutional support, though, that limit movement toward technology. Socially based, these forces are manifest primarily in administrative attitudes and extend to their respective staffs. As reflected in a formalized sense, the key principles of industrial society are an integral part of the institution. This is apparent in the standardized work week, synchronized work day, specialized offices, centralized decision making, and maximized campus configurations. The flexibility, demassification, and semi-direct democracy, which are predicted to come about in a technological society, are evident only in a few areas such as campus forums and the summer four day work week.

This lengthy description of Institution B served to demonstrate the application of a theoretical model to a specific higher education institution. A hypothesis of this paper is that the model can be applied to a large number of institutions, especially community colleges. While the exact configuration of institutions may differ, most institutions undoubtedly are subject to both external and internal disequilibrium. The concluding portion of this paper is devoted to a set of recommendations for long range institutional planning. The purpose of the recommendations is to bring about equilibrium through transition in a state of motivation, not frustration.

Recommendations

Seven recommendations are set forth. The first three are derived from the theoretical framework; the last four are common to institutional planning. Each recommendation will be stated in generalized form.

Analysis of Institutional Forces

This recommendation is set forth in recognition of the importance of social, political, and economic forces within an institution. Social forces can be determined by assessing faculty, student, staff, administrative, and governing board attitudes. Political forces can be assessed by studying the formal and informal decision-making process and organizational structure. The annual budget reflects economic forces as expenditure allocations and trends reveal priorities and direction.

Identification of Institutional Point in Transition

The second recommendation requires the planner to study an industrially oriented institution and a technologically oriented one. From this study, a determination is made of the number of industrial characteristics manifest in the planner's institution and the number of technological ones. Most institutions will have more of one type than another. The purpose of this recommendation is to determine to what extent the institution is in disequilibrium with society.

Design of Institutional Configuration

This recommendation addresses the need to identify the extent of disequilibrium within an institution. Before any specific goals can be set, it is important to know which areas of the institution lag behind and which areas are moving ahead. To the extent that variability ranges only moderately, the institution will have less internal disequilibrium, which likely will enhance its ability to reduce societal/institution disequilibrium.

Establishment of Long Range Goals

This recommendation is familiar to all institutional planners. As it relates to the purpose of this paper, however, these goals establish a point on the continuum toward which the institution would like to move. For an Institution like A, this goal would probably be at the point where Institution B, not C, is located. This suggests that even long range goals should be based upon the theory of equilibrium/disequilibrium and that to set too large a span may result in institutional frustration.

Development of Objectives to Achieve Goals.

This fifth recommendation, known to planners and managers as well, also is derived from the theory of equilibrium/disequilibrium. It is at this level that the institutional configuration becomes even more important. Specifically, what objectives can be formulated in functional areas of the institution that will lesson differences among functions, ultimately to achieve the long range goal?

Formulation of Activities to Attain Objectives

This recommendation incorporates faculty and staff into the planning process. At this level, activities are formulated within institutional functions to bring about a greater degree of equilibrium. For example, if occupational programs are more technically advanced than transfer programs, activities should be formulated to advance gradually the status of technology in transfer programs; more specifically, within transfer programs, some departments may be more advanced than others. Activities to bring them to a more common point would be desirable.

Incorporation of Evaluation Mechanism

The key to the entire planning process is a means to modify and improve the process in an on-going manner. Especially important to the process recommended herein is the evaluation of whether the goals, objectives, and activities were established at a point that resulted in motivation or frustration. Thus, continual efforts are made to identify more precisely the appropriate amount of movement toward a technological society.

Limitations

In concluding this paper, a few limitations are noted. The paper is based almost exclusively on the work of Alvin Toffler's description of the past and projection of the future. Thus, only to the extent he has been accurate is the paper reflective of the future. Second, the author attempted to apply Toffler's work to higher education. There may have been some misinterpretation in this application. Third, the framework for this paper included only three institutional functions: other, equally important functions, such as research and public service were omitted. Inclusion of these may have altered the framework. Fourth, the discussion was more appropriate to one segment of higher education, community colleges, than to others.

Fifth and most important, like the theory of disequilibrium/equilibrium, the expanse of the paper may have been too broad, creating frustration rather than motivation in the reader. This span was deliberate, however, and intended to illustrate the underlying theory of the paper. As the reader may also have observed, Models One through Three represented transition from an industrial to a technological society. Model One illustrated the industrial principles of standardization, synchronization, and specialization. Model Two, in changing, began to move away from these principles, yet still retained them. Model Three, indicative of a technological society, demassified the institution, integrated functions and forces, and allowed for internal differentiation and individuality.

In conclusion, Toffler views the future as follows:

> "The dawn of this new civilization is the single most explosive fact of our lifetimes. It is the central event -- the key to understanding the years immediately ahead. It is an event as profound as that First Wave of change unleashed ten thousand years ago by the invention of agriculture, or the earthshaking Second Wave of change touched off by the industrial revolution. We are the children of the next transformation, the Third Wave."[6]

[6] Op Cit, p.25.

Figure One

Model One - INDUSTRIAL HIGHER ED INSTITUTION IN EQUILIBRIUM

SOCIETAL INFLUENCES	INSTITUTIONAL FUNCTIONS		
	Instruction/ Instructional Support	Student Services	Institutional Support
Social	• Traditional core curriculum • Classes synchronized • Lecture/recitation predominant methodology • Books only resource • Highly specialized depts., separate facilities • Large lecture halls	• Large counseling staff • Services available 9-5 for full-time students only • Manual registration	• White, male administrative staff • Large female clerical staff
Political	• Hierarchical, centralized decision making • Faculty senate	• Fluctuating priority	• Line or staff organizational positions • Hierarchical structure • Centralized decision making
Economic	• Increased allocations for new faculty positions • Increased allocation for library holdings • Increased allocation for new facilities	• Fluctuating according to political priority	• Increased allocation for new staff personnel

Figure Two

Model Two - HIGHER EDUCATION INSTITUTIONS IN TRANSITION (DISEQUILIBRIUM) FROM INDUSTRIAL TO TECHNOLOGICAL SOCIETY

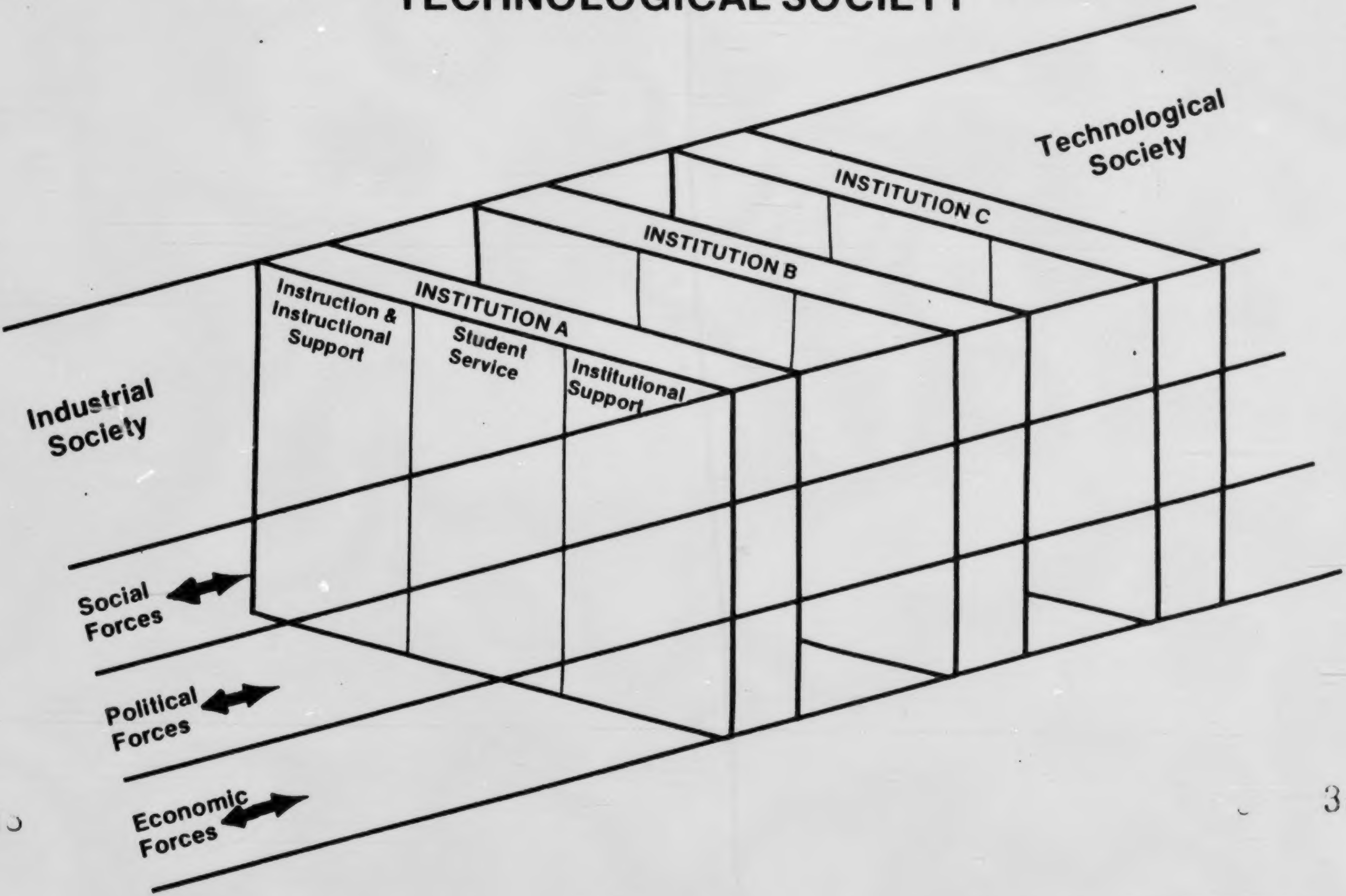
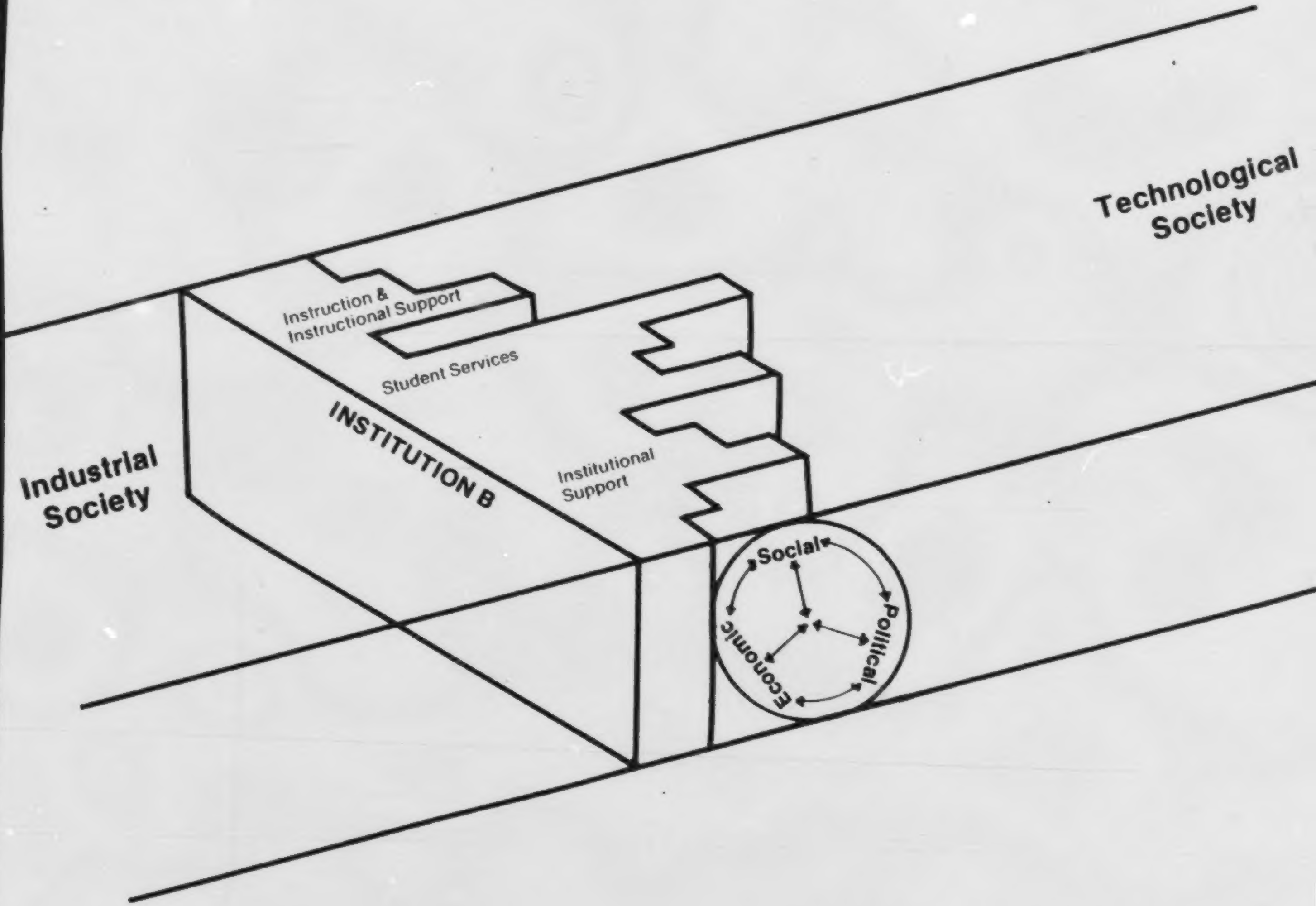

Technological Society
INSTITUTION C
INSTITUTION B
INSTITUTION A
Instruction & Instructional Support
Student Service
Institutional Support
Industrial Society
Social Forces
Political Forces
Economic Forces

Figure Three

Model Three - HIGHER EDUCATION INSTITUTION IN TRANSITION (DISEQUILIBRIUM) FROM INDUSTRIAL TO TECHNOLOGICAL SOCIETY AND AMONG FUNCTIONS


Technological Society
Instruction & Instructional Support
Student Services
INSTITUTION B
Institutional Support
Industrial Society
Social
Political
Economic

INFORMATION SYSTEMS IN HIGHER EDUCATION: PERSPECTIVE FOR THE EIGHTIES

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It should be no secret to those of us in higher education that the 1980's will indeed be challenging times. The management of institutional growth has been replaced by the management of institutional survival. During the 1970's, higher education administrators were faced with limited resources and increased pressures to make informed decisions. They became increasingly reliant upon administrative information systems to satisfy managerial as well as operational needs. Facing these same pressures today, institutions of higher education will continue to rely upon these systems during the difficult times they face in the new decade. This paper reviews the role of information systems in higher education. It reports data on the use of administrative computing and projects some future trends.

INFORMATION SYSTEMS IN HIGHER EDUCATION:
PERSPECTIVE FOR THE EIGHTIES

Introduction

In 1966, Frances E. Rourke and Glenn E. Brooks, in their book The Managerial Revolution in Higher Education, reported on the beginning of some significant administrative changes in American higher education. They predicted that "a new world of computer management and control lies ahead in higher education." (Rourke and Brooks, p. 18.) In the 14 years since this prognostication, substantial work has been undertaken in the development of computer-based management information systems (MIS) in higher education. It was recently reported that annual expenditures for administrative computing were approximately $446 million (Hamblen and Baird, p. III-5). The major investment being made in administrative computing during times of financial exigency in higher education may cause faculty, students, and staff to question these expenditures. However, these systems will be required if institutions expect to meet the challenge of survival in the 1980's.

Higher Education

The future of higher education is somewhat clouded. The opening pages of Three Thousand Futures, the recently published final report of the Carnegie Council on Policy Studies in Higher Education, set the tone:

> Since 1870, enrollments in higher education have grown at a compound annual rate of 5 percent; ahead of the total population growth of 1.6 percent. Resources used by institutions of higher education

> have increased from what we estimate was 0.1 percent of the GNP in 1870 to 2.1 percent presently (not including construction).
>
> During the next 20 years, enrollments may fall even as the total population continues to rise; real resources available to and used by colleges and universities also may decline, even if and as the total GNP keeps increasing. (Carnegie Council, p. 1.)

But despite this and other pessimistic observations on the future of higher education, it will survive the current crisis. It may, however, emerge as an even more complicated system because of increased demands for efficiency and effectiveness in a period of stable or declining resources. Rourke and Brooks' forecast of increasing reliance on computer management and control, which first came to fruition in the 1970's, will more fully emerge in the 1980's. As institutions struggle for survival, they will turn with increasing frequency to computer-based management tools.

Information Systems in Higher Education

Total expenditures for computing in higher education, as shown in Table 1, have grown from $220 million in 1966-67 to nearly $1 billion by 1976-77. It is projected that by 1985, these expenditures will exceed $1.5 billion annually. Institutions with access to computer facilities increased from 39% in 1966-67 to nearly 69% in 1976-77. (Hamblen and Baird, pp. II-05, III-5, III-6.)

Substantial growth has also occurred in the administrative use of computers. Table 1 shows that in the 10 years from 1966-67 to 1976-77, expenditures for the use of computers by administrative units increased from 30% to 45% of the total expenditures for

TABLE 1: ESTIMATED DISTRIBUTION OF EXPENDITURES FOR ADMINISTRATION, RESEARCH, AND INSTRUCTION USES OF COMPUTERS IN U.S. HIGHER EDUCATION FOR FISCAL YEARS 1967, 1970, 1977.

	1966-67		1969-70		1976-77	
	%	millions	%	millions	%	millions
Administration	30	$ 66	34	$161	45	$446
Research	40	$ 88	32	$151	22	$218
Instruction	30	$ 66	30	$142	27	$268
Other	--	----	4	$ 19	6	$ 59
TOTAL	100	$220	100	$473	100	$991

Source: Hamblen, 1970, 1972; Hamblen and Baird, 1979.

computing in higher education. (Hamblen and Baird, p. III-1.) If the figure remains constant (though there is no reason to believe it won't continue to increase), administrative computing expenditures will exceed $675 million annually by 1985. (Hamblen and Baird, pp. III-1, III-5.)

The presence of computers, however, does not guarantee the presence of management information systems. One of the first studies of management information system development was conducted in 1969 by Leo Kornfeld. He surveyed 76 institutions to determine the levels of sophistication attained by their computer-based management information systems. He found that only seven schools had achieved an advanced state of the art. (Kornfeld, p. I-2.) Lawrence Bogard studied the development of several analytical tools, one of which was management information systems. He found that 13% of the institutions reported having a computerized management information system.

One of the most recent comprehensive surveys was completed by Richard L. Mann in 1973. Mann reported that of those institutions with 3,000 or more students enrolled, nearly 70% reported they were actively planning or implementing a management information system. Of those institutions reporting, 40% had a MIS in partial operation, 28% were still planning, and less than 1% stated their MIS was fully operational. (Mann et al, p. 19.) A study is currently underway at The University of Michigan's Center for the Study of Higher Education to provide an assessment of management information systems today and the progress that has been made since Mann's study in 1973.

Future Trends

The projection of future trends in administrative computing and management information systems in higher education is a difficult task. It is one thing to predict technological advances, but a different matter to predict the assimilation of that technology into the administration of colleges and universities.

The cost of computers has been declining in recent years, and likely will continue to do so in the 1980's. On the other hand, personnel costs have been increasing, and will undoubtedly continue to dominate computing budgets in the 1980's. Thus, it seems apparent that one likely development will be to reduce the number of personnel involved in systems development. One method would be to acquire more application software packages rather than developing the applications within the institution. Another potential trend may be the increased use of user-oriented general purpose inquiry programs which will reduce the involvement of systems personnel in access to data by end-users.

Still another trend, of a more technological nature, is the development of microcomputers, minicomputers, and distributed processing. Since these three approaches emphasize close involvement with the user, it will become essential for college and university administrators to become more literate about computers, data processing, and information.

Staman has predicted that:

> As management becomes more confident in its computing systems, the myriad filing cabinets...may begin to disappear...more reporting by exception and more analysis in the reporting...will be developed. As computing becomes integrated into the organizational structure, the manager will increasingly view information as another institutional resource. The impact of computing in higher education is really just beginning to be felt. (Staman, pp. 99-100.)

As the pressures mount for increased efficiency and effectiveness, and as institutions struggle to survive, the advantages of management information systems will become extremely significant. The capability to facilitate management decision-making through the availability of relevant institutional information will make the development of management information systems in many academic institutions a required task.

References

Bogard, Lawrence, "Management in Institutions of Higher Education," Papers on Efficiency in the Management of Higher Education. Berkeley: Carnegie Council on Policy Studies in Higher Education, 1972.

Carnegie Council on Policy Studies in Higher Education. Three Thousand Futures. San Francisco, Jossey-Bass, 1980.

Hamblen, John W., Inventory of Computers in U.S. Higher Education, 1966-67. Washington, D.C.: National Science Foundation, 1970.

Hamblen, John W., Inventory of Computers in U.S. Higher Education, 1969-70. Washington, D.C.: National Science Foundation, 1972.

Hamblen, John W. and Baird, Thomas B., Fourth Inventory of Computers in Higher Education, 1976-77. Princeton: EDUCOM, 1979.

Kornfeld, Leo, Advanced Applied Management Information Systems in Higher Education: Case Studies. Prepared for WICHE-ACE Higher Education Management Information Systems Seminar. The Sterling Institute, Washington, D.C. (April, 1969; revised June, 1969.)

Mann, Richard L.; Thomas, Charles R.; Williams, Richard C.; and Wallhaus, Robert A. An Overview of Two Recent Surveys of Administrative Computer Operations in Higher Education. Boulder, Colorado: National Center for Higher Education Management Systems, 1975.

Rourke, F.E. and Brooks, G.E., The Managerial Revolution in Higher Education. Baltimore: Johns Hopkins Press, 1966.

Staman, E. Michael, "Trends in Administrative Computing," in Staman, E. Michael, and Peterson, Marvin W., eds., Examining New Trends in Administrative Computing. New Directions for Institutional Research, No. 22. San Francisco: Jossey-Bass, 1979.

MOTIVATION: THE MANAGER'S DILEMMA

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MOTIVATION: THE MANAGER'S DILEMMA

The often-heard laments of our fellow managers - "What can I do to motivate my staff?" or "Why don't they see that there's work to be done, and do it?" - often conclude with comments such as "The young people today don't work as hard as the young people did years ago", or "She doesn't have to work, her husband makes enough for both of them." Do these sound familiar? You bet they do! In fact, most of us as managers have probably expressed these same concerns at some time during our professional careers.

To the managers agonizing over these problems (and probably being very concerned about their own success being limited by their "unproductive" employees) several immediate solutions come to mind --- "We need to improve their salaries", "They all need private offices in which to work", "Let's bring in the computer people to see if they can do the hum-drum work for us". Do these sound familiar? Again, I would bet that they do.

What do these comments tell us? They tell us that as managers we sense our responsibility for motivating our staff, that we're unsure of what the factors are that affect motivation, and we're looking for ways, as managers, to improve motivation. The purpose of this article is to give some insight into the factors affecting motivation and what managers can do to improve their staff's motivation. To do this, we're going to look at the conclusions of the research of several behavioral scientists, and we're going to compare these conclusions to the guidance given by several successful people - like John Downey (Meredith Printing), IBM's Buck Rogers, and J. C. Penney.

WHAT IS THE MANAGER'S DILEMMA?

Motivation, or as some would say - "getting people to work" - has been a concern of leaders for thousands of years dating back to the times when people first banded together to do things as a group. Historically, up to about the latter 1800's, motivation followed the military model of "do it-or else". What it amounted to was that a worker was threatened with the loss of his essentials - food, shelter, security - if he didn't work. Things have really changed! Today we're more concerned about the quality of peoples' lives and we've enacted social legislation to ensure that quality. Many managers don't agree that these changes have been for the better. Many feel it's made their jobs almost impossible. Now, instead of making their people work, they've got to "motivate them to work". But they have recognized reality and today's managers, whether eagerly or begrudgingly, are looking for ways to motivate people in today's working environment.

Those are the key words in their thinking; that is "they're looking for ways to motivate people in today's working environment". Managers recognize when they use the words "today's working environment" that the old authoritative, autocratic techniques no longer fit. Society has changed and peoples' values have changed. Therefore, management styles must change with them. This is pretty well understood by today's managers. But the beginning of the key words, "looking for ways to motivate people" is where many managers go wrong in their thinking. This implies that they feel motivation is something created by manipulating salaries, desk locations, circulation of memos, etc. But in the computer profession, our salaries are good, generally our working conditions have greatly improved, and our jobs have significant social status. Yet, with all of this, why are we still concerned about motivation problems?

To understand the answer to this question, let's look at the work of A. H. Maslow. Those of you who have studied some organization behavior science may recall that Maslow, in the mid-1950's, published a theory of hierarchical need priorities. His theory is generally expressed in the following table:

1. Basic Physiological Needs	Primary
2. Safety, Security	
3. Belonging, Social Activity	Secondary
4. Esteem, Status	
5. Self Realization, Fulfillment	

This theory generally implies that a man will fight to solve his basic needs, he will struggle violently to solve his safety and security needs, and then, after the primary need levels are met, he will begin to look after his secondary level needs. The secondary need levels are social and self needs.

The point here is that those managers who believe motivation is provided by salary, working conditions, pension plans, etc. are dealing only with the primary needs as defined by Maslow. Yet, at these levels, motivation is not provided by giving people higher salaries, etc.; but rather motivation is provided by taking things away! At these need levels, taking things away will motivate people to get them back. This is a negative, dysfunctional motivation in that it can promote behavior which is unethical, maybe even disruptive, with extreme examples being strikes, slowdowns, sabotage, etc. An inference from Maslow's model is that if employees are exhibiting a behavior which clearly indicates that their primary needs are not being met, we as managers must work to satisfy them. This is essential to have a functional working environment. We must recognize also that this is satisfying needs, it is not providing motivation. Here is the answer to our question as to why we as managers of computer professionals with good salaries, working conditions, etc. are still worried about motivational problems. It is because these factors affect people's primary needs and, as I've described, should be generally thought of as "negative motivational" factors.

Maslow's contribution to management as a science is the recognition of these need levels and the definition of the relationships among them. Functional motivation, from Maslow's model, is achieved at the secondary need level. It's pretty clear to us, what management "tools" to use for "motivation" at the primary need levels, but at the real payout secondary levels, the tools are less familiar.

From Maslow's model of hierarchical need priorities, let's turn to today's research. What conclusions are the behavioral scientists reaching from current research? The research shows that overall the employee is not the driving force affecting their motivation. Rather, research shows that it is the manager's own behavior which is the predominant factor in employee motivation. Employees are a reflection of their manager!

That is worth repeating - research shows that it is the manager's own behavior which is the predominant factor in employee motivation. Employees are a reflection of their manager! Jay Hall in his excellent paper titled "To Achieve or Not: The Manager's Choice" makes this inferential statement: "The needs and quality of motivation characterizing a manager's subordinates may say more about the manager than about his subordinates."

This is the manager's dilemma! It is not his employees' lack of motivation that is the problem - rather it is his own behavior which may need changing. Successful managers already know this! I like to quote J. C. Penney for several reasons. He's been a successful executive, he's often very quotable, and he began his climb to success in the state where my university is located - Wyoming. In getting along with others, he says, "It's not so much learning how to get along with others as taking the kinks out of yourself so that others can get along with you." From his thoughts you can see he already knew what the behavior scientists are confirming in their research, that our behavior is the primary factor affecting the behavior of those close to us. For those of you who would like to look into the research which results in the conclusion of the manager's dilemma concerning employee motivation, I would recommend reading Jay Hall's paper. But the conclusion of the research is obvious, and for those managers who are more interested in answering the question "How do I motivate my staff", I would like to go on to the work of other people to help find some answers.

To begin the study for answers, I would like to set the tone with some advice from John Downey, Vice President for Meredith Printing; "If you want to be a manager, you must learn to think like a manager." His advice breaks down into three components; you must decide to be a manager, you must decide to learn, and you must decide to think like a manager. I believe this is the sense we should have to reach a solution to "the manager's dilemma" concerning motivation.

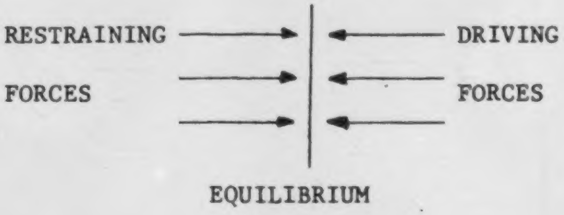
INFORMATION FROM BEHAVIORAL SCIENTISTS

A general guide to answers and a methodology for finding solutions can be found in the work of three behavioral scientists - Kurt Lewin, Frederick Herzberg, and Victor Vroom. Their works which we will use are Lewin's Force Field Analysis, Herzberg's Two Factor Motivational Model, and Vroom's Expectancy Model.

Kurt Lewin's Force Field Analysis is a problem solving tool. It will be presented first and used later to reach some conclusions. This tool is a very simple technique, but also very powerful. The Force Field analysis model can be described as

> "every condition is an equilibrium which is achieved by a balance of driving forces and restraining forces."

Graphically, this concept is illustrated as follows:

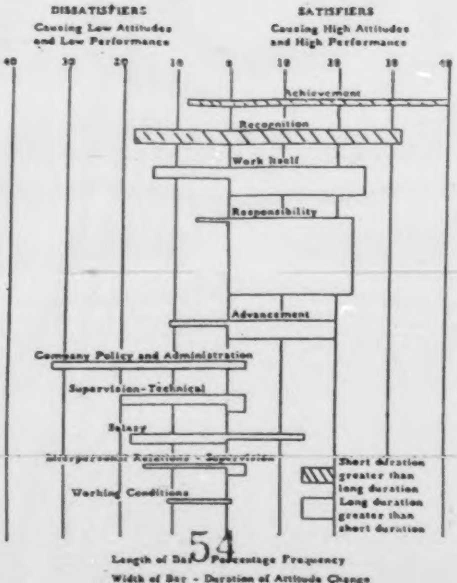


where the equilibrium plane represents the current situation; the driving forces attempt to push the plane to the left creating a larger, favorable area; and the restraining forces hold it back. This is a very simple tool but also very valuable (a concept which should be familiar to us in Data Processing since our experience has always been that the simple system is the best working system). Using this tool helps us recognize that there are several factors which encourage a behavior and several which discourage it; the resulting equilibrium is the behavior we see. A good demonstration of this tool may be to look at some of the possible pros and cons of going to the CAUSE Conference. Assuming that we wanted to go but weren't quite sure whether we could, we probably began by defining in our own minds the driving and restraining forces. Let's assume they were as follows:

Restraining	Driving
1. not enough travel money	1. learn new information
2. child's birthday	2. discuss problems
3. projects due	3. get away from office
4. spouse unhappy	4. play golf

Knowing these forces enables you to objectively study them and work out strategies to change them. Possible solutions to reduce restraining forces in the above example are - deciding to spend some of your own money to go to the conference; plan an extra special, early birthday party for the child; ask for deferral of project due dates or assign to someone else; buy spouse a season ticket to a health spa. The real power of this tool is in taking things out of the realm of the unknown. Thus by identifying the driving and restraining forces, it enables you to modify or eliminate a force thereby causing a shift in the equilibrium plane to a solution more desirable to you. This tool can be applied in many day-to-day situations, such as analyzing the strengths or weaknesses of a department, and I would encourage you to use it. We could spend more time developing our knowledge of how to use this tool, but, for our purposes here, we need only understand it conceptually so that we can use it later in defining the manager's role in motivation.

The second piece of behavioral scientist work we will look at is Frederick Herzberg's Two Factor Motivational Model. Dr. Herzberg's work was developed in the late 1960's. It has received some criticism because of the research methods which were used, but it is still accepted as viable in a relative sense. In particular, he draws a distinction between motivation factors and those factors which deal with job content. There are several pictoral representations of Herzberg's work; the following is one I refer to often.



In the diagram we see five factors labeled as job satisfiers (or motivators) and five factors as dissatisfiers (or maintenance factors). What Herzberg proposes is that the "dissatisfiers" of salary, working conditions, policy and administration, etc. provide little if any satisfaction. At best improving the "dissatisfiers" tends only to raise people's "satisfaction level" to the point where they are not dissatisfied. There may be individuals who are exceptions, but, in general, improving a "dissatisfier" such as salary does not improve motivation, it simply eliminates a dissatisfaction. As a result these factors are called maintenance factors. It is also correct that if employees are unhappy as a result of a dissatifier, it is difficult at best to improve on the satisfiers.

Now, let's take a look at the satisfiers, or motivational factors defined by Herzberg. All of these factors can also provide dissatisfaction, and the manager must pay attention to that. Two of the factors - achievement and recognition - have a short duration effect but a high frequency. This implies that the manager must attend to these factors frequently because the need is there, and the effect is of short duration. The other factors - responsibility, achievement and work itself - all have lower frequencies and longer duration effects. The payback from these factors is higher, and they will probably need attention less frequently.

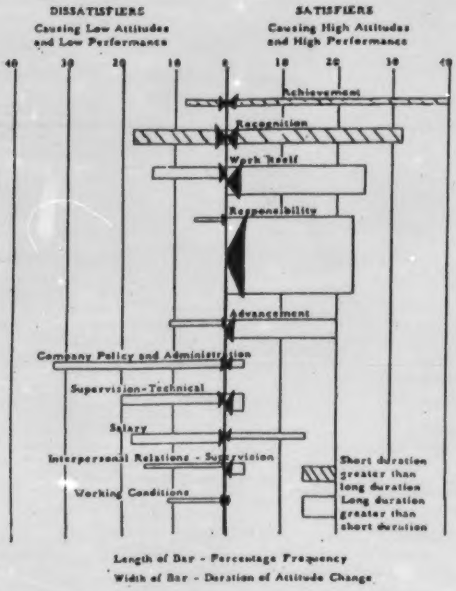
From Herzberg's model we gain an understanding of those maintenance factors which must be taken care of to reach a functional motivation environment, of those factors which actually improve motivation, and of their relative importance in terms of frequency and duration.

Often, at this point, people start to recognize similarities between Maslow's and Herzberg's work. These similarities do exist as the following table shows:

	MASLOW	HERZBERG	
Secondary	self realization and fulfillment	work itself achievement responsibility	Motivators
	esteem and status	advancement recognition	
	belonging and social activity	interpersonal relations supervision	
Primary	safety and security	company policy and administration	Maintenance
	physiological needs	salary	

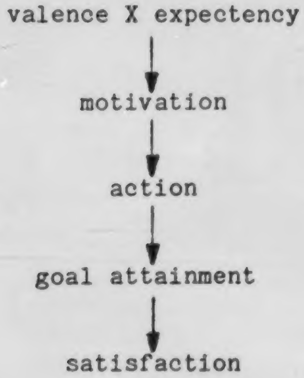
Maslow's work dealt with the person whether at work or somewhere else, where Herzberg studied work environment conditions. Both of them point out that lower level needs must be taken care of; and that the higher level needs are the motivational factors. One caution here; this is information which generally applies to everyone. There will always be some individual exceptions; that is, there will always be some individuals who are highly motivated by salary or the like. Another caution is that the higher level needs or motivational factors can be applied to all groups of employees, but possibly with somewhat less success to blue collar employees.

Let's turn now to using Kurt Lewin's force field analysis with respect to Herzberg's chart, with forces replacing the satisfiers and dissatisfiers.



This chart is a more powerful representation of the effects of "satisfiers" and "dissatisfiers" on the equilibrium plane of motivation. Herzberg gathered his data from real people in real work situations. This chart then represents the maximum possible effect of the "satisfiers" on the motivation plane, and the maximum possible effect of the "dissatisfiers" on holding back the motivation plane. This shows us opportunities as managers! Eliminating or preventing a dissatisfier from occurring will create a favorable climate for motivation. Then providing "satisfiers" will result in improved motivation. When you look at the motivational factors, who do you see as the person providing the recognition of a job well done, who defines challenging tasks that result in a sense of achievement, who provides meaningful work assignments, and who provides a structure to the work situation that results in everybody having a sense of responsibility? The answer, of course, is the manager.

What we have attempted to portray here (and I hope successfully!) is that a staff does not lack motivation by themselves, but rather motivation is not being developed by the manager. The final model which I will present to support this is Victor Vroom's Valence-Expectancy model, the commonly accepted model of motivation.



Vroom's model shows the product of valence and expectancy which sets off the chain process beginning with motivation and leads to the final results desired. Valence is defined as the strength of a person's preference for one outcome over another outcome. Expectancy is defined as the strength of the belief that a particular act will be followed by a corresponding outcome. If the employee does not have a high preference and a high belief, where will it come from? How will the chain process be set off? It comes from leadership and effective communications. It comes from the manager.

WHAT CAN A MANAGER DO?

At this point, I hope we all perceive that the behavioral scientists are showing the way, and that the credit for good employee motivation or the responsibility for poor motivation resides with the manager.

There are several things I think a manager can do. First is to decide to be the manager, to be the leader, to decide employee motivation will change only if your behavior changes. Second, use the Lewin Force Field analysis to analyze what factors are affecting your motivation situation. Third, keep in mind the factors defined by Maslow, Herzberg, and Vroom in developing your force field analysis, and in deciding upon your plan of action. Determine if the problem is your University (that is the dissatisfiers have not been taken care of) or if the problem is you. If there are some dissatisfiers present - you must take care of them. First because it will be difficult for you to improve motivation until they are taken care of; second because your staff must perceive that you have the capability to solve these problems and to reward their performance.

ADVICE OF SUCCESSFUL PEOPLE

With respect to how managers actually motivate, there is no precise formula or game plan for us to follow. This is a skill we must learn and develop for ourselves. When we look at the advice of successful people we see they all understand the motivational process similarly, but I'm sure we realize their styles are probably all different. The same will be true for us. We can understand how successful people think, but we will have to adapt a style which works well for each of us.

There is a veritable treasure chest for us in the advice of successful people. Advice, which as John Downey recommends, we use to "learn to think as managers". One important feature of the advice is that it matches the findings of the behavioral scientists. Yet many of these people reached this level of understanding before the work of the behavioral scientists was developed. This tells us the behavioral scientists' advice has been proven in practice and without the bias of prior knowledge of the scientists' work.

"When people ask me," says J. C. Penney, "'What one factor do you believe has contributed most to the growth and influence of your organization?', I don't have to stop and think about an answer. Unquestionably, it has been the emphasis laid from the beginning upon human relationships - toward the public on one hand, through careful service, and giving the utmost in values; toward our associates on the other hand". With these attitudes toward people and commitment to service how would you imagine Penney used the factors of responsibility, recognition, achievement, advancement to motivate his employees?

Buck Rogers, IBM, at a CAUSE conference several years ago, gave his guidelines for success as an executive:

1. Respect for people.
2. Expect excellence.
3. Decide to deliver the highest possible service.

Thinking back on what Herzberg describes as motivational factors and using Roger's guidelines we understand how he motivates. He has a positive attitude toward his staff and toward his clients, he has a positive view toward what he expects his people to accomplish, and he has a positive view toward what he expects his group to do for their customers. His sense of positiveness affects the manner in which he works with his staff, and their resulting sense of responsibility, recognition, achievement.

Jay Hall is president of Telometrics International, a firm which provides management training services. In addition to being a successful executive he is also a behavioral scientist. He concludes his article "To Achieve or Not: The Manager's Choice" with the following:

> Managerial achievement ... depends ... on the manner in which the manager behaves in conducting organizational affairs, on the values he holds regarding personal and interpersonal potentials...

Each of these three executives has the same conceptual basis for success - high regard for interpersonal relations, high expectations of people, and high commitment to service.

WHAT DO WE DO?

All of this advice may be new to some of us, but whether its new or not, we should all heed Lawrence Appley's advice (past chief executive officer of AMA), "Those who are students of management before they enter it and continue to be students of it while they are in it, will have a better chance of success than those who do not!"

From the advice of successful executives, we can decide to do the following:

A. Again, decide to be a manager

B. Recognize the value of studying other successful executives

C. Make a commitment of time and effort to regularly attend courses at one of the many excellent management institutes throughout the country

Whether we're trying to learn these concepts and develop skills, or whether we're trying to keep our skills sharp, we must regularly expose ourselves to this learning experience. Appley's advice is very important.

CONCLUSIONS

From the current behavioral science research we've developed the basis for the manager's dilemma with respect to motivation; it is his own behavior which affects his staff's motivation.

From what successful people think are the factors which led to their success - high regard for interpersonal relations, high expectation of people, and high committment to service - we can see how their advice correlates with the findings of the behavioral scientists. It always comes back to how we as managers behave towards our staff.

From the work of behavioral scientists and the advice of successful people, we have guidelines to assist us in developing an action plan to improve our abilities to motivate our staff:

a. decide to be a manager
b. use the Lewin Force Field Analysis technique to analyze problems
c. use concepts of Maslow, Herzberg, and Vroom
d. study other successful managers
e. commit your time and effort to attend courses in management

In the final analysis, it is our action plan and how well we execute it that will determine how successful we will be as managers.

KEY EXTERNAL DATA REQUIRED IN STRATEGIC DECISION-MAKING

A NEW ROLE FOR MANAGEMENT SYSTEMS

by

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ABSTRACT

Management information systems in the past have tended to focus on data elements relating to internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting, and other administrative applications. Strategic decision making as a part of the higher education planning process, however, is becoming increasingly more dependent upon data elements external to the institution. This issue is so important that the American Association for Higher Education launched a trend-awareness project in 1978 and the American Vocational Association adopted a resolution at its 1979 Convention to create a task force to develop a mechanism for determining the directions of changes in vocational education. This paper will (1) analyze the context or environment or setting in which post-secondary education takes place, (2) examine the maturation of the planning function, and (3) discuss the challenge to management systems for postsecondary education for the 1980s.

> The future holds many unknowns. It also holds a range of already known choices that can be made by those making decisions about higher education....External, particularly market, pressures will not alone lead to the best results. Internal thought, resolution, and determination are needed to assure that higher education as a whole and institutions individually reach 2000 with capacity to perform undiminished or minimally diminished by the demographic depression. The surrounding environment in the next 20 years will create some special problems that we can already see. It does not, however, determine in advance how well these problems will be solved or how inadequately human choice, or absense of choice, will settle that. A downward drift in quality, balance, integrity, dynamism, diversity, private initiative, research capability is not only possible--it is quite likely. But it is not required by external events. It is a matter of choice and not just of fate. The emphasis should be on "managing of excellence."
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> Three Thousand Futures: The Next Twenty Years for Higher Education Final Report, Carnegie Council on Policy Studies in Higher Education, Jossey-Bass, 1979.

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As I began to develop the outline of this presentation, I was reminded of the story of the Chinaman asking his son, "Do you know who pushed our outhouse into the Yangtze River?" His son replied, "No." Again he asked his son, "Do you know who pushed the outhouse into the Yangtze River?" Again his son replied, "No." The Chinaman then told his son the story of George Washington cutting down the cherry tree and how his father did not spank him because George told the truth. At the conclusion of the story, the Chinaman again asked his son, "Do you know who pushed the outhouse into the Yangtze River?" This time the son replied, "I cannot tell a lie father, I did it." The Chinaman immediately spanked his son. The son was confused and asked his father why he was spanked for telling the truth and Geroge Washington was not. The Chinaman simply stated that George Washington's father wasn't sitting in the cherry tree when George cut it down. The principle that is involved in the story is simply - "Where you stand is where you sit."

From where I sit, it seemed logical to build the outline of this presentation around three limited but achieveable objectives.

1. To analyze the context or environment or setting in which postsecondary education takes place.
2. To examine the maturation of the planning function as it relates to keeping postsecondary education viable in the years ahead.
3. To discuss the challenge to management systems for postsecondary education for the 1980's.

The Context of Postsecondary Education

In the Fall of 1968, John W. Gardner, former secretary of Health, Education and Welfare, strode to the podium at the annual meeting of the American Council on Education and launched a double-barrelled assault on higher education for its lack of initiative in dealing with problems of urban life. He declared, "The colleges and universities of this country have not responded impressively to the urban crisis. They have been notably laggard...very few have pursued any aspect of the urban crisis with the intellectual rigor it requires. Even fewer have accepted the real world of the city on their doorstep as a laboratory in which they can advance their intellectual purusits."

Institutions of postsecondary education are "of society." That is to say, they are created to fill a role that society has deemed necessary as it related to its well being. Viewed in this light, postsecondary education takes its place alongside elementary and secondary education, human services government, housing, and transportation as it attempts to impact on the quality of life. Postsecondary education at one time stood as the giant oak as the primary source of knowledge/information generation and transmission. Postsecondary education had exclusive right on a monopoly. Since an early study published in 1961 by the American Council on Education, business and industry has become involved in education and training in a big way.[1] An article in the October 1978 issue of the American Association of Higher Education Bulletin begins as follows:

> An extensive education and training system exists in private industry and government. The National Conference Board, for example, reports that in the single recession year of 1975 the nation's 7,500 largest private employers spent over $2 billion on employee education--as much as the recent annual totals of all contributions from all sources to colleges and universities. And while college and university-based education is stabilizing and/or declining, the training and development sector in business, industry, and government is expanding rapidly.
>
> Several years ago Kenneth Boulding gave us a warning by drawing an analogy between higher education and that other industry in decline--the railroads. The problem, he said, was that railroad managers did not view themselves as part of a larger transportation system, but simply as manager of an isolated segment, the railroads.

An article in The New York Times[3] begins as follows:

> Last year the American Telephone and Telegraph company spent $700 million on education programs for its employees, or more than three times the $213 million annual budget of the Massachusetts Institute of Technology.
>
> Sixteen courses run by McGraw-Hill for its employees have been approved for college credit by the New York State Department of Education. At Honeywell, Inc., in Minneapolis more than 3,500 employees enrolled this year in 183 courses ranging from solar heating and cooling to women in business.

The introduction to an article in the May 1980 issue of the Training and Development Journal[4] is as follows:

> Industry spends on employee education more than six times the amount appropriated by all the states for all of higher education! If money is power, then industry occupies a power position in continuing education.
>
> Industry is not only a major consumer of continuing education provided by others, it is also a major provider of continuing education, with large "in-house" training staffs and facilities. If competition is conflict, then industry is a source of conflict in continuing education, competing directly with other providers and pitting provider against provider as bidders for its continuing education dollars.
>
> Robert Kost points out that industry's principal objective in continuing education is pragmatic: Continuing education should provide skills and knowledge that will improve employees' capabilities and be reflected in the quality of their performance and in their productivity. But industry is not so pragmatically profit-oriented that its concept of continuing education is totally restricted

> to task-related training; there is considerable support for Quality of Work Life programs, and the liberal arts as well as industrial arts.
>
> Industry, Kost says, wants to cooperate with educational institutions, yet is not receiving the response it expects from academic sources, which is surprising in view of the widely-held assumption that such sources are securing degree-granting accreditation.

An article in the September 1980 issue of the American Association of Higher Education Bulletin states:[5]

> A majority of adult Americans are getting their education outside college and university settings, and the financial resources devoted to this enterprise are staggering: 58.4 million adults each year are involved in some form of organized education, only 12.4 million of them in colleges and universities. Programs offered by business, government agencies, professional associations, other organizations, and the telecommunications field are responsible for educating nearly five times as many of these adults as are higher education institutions. The American Society for Training and Development estimates that American business devotes $40 billion annually to employee education exclusive of college programs.

The point that John Gardner was making is that if postsecondary education is truly doing its job, it has an impact on virtually every institution of society. If postsecondary education is to remain viable in the years ahead, it must be cognizant of societal forces, trends, and effects as they occur in the college context and service environment.

Maturation of the Planning Function

The future of any institution, including postsecondary education, rests on the degree to which it meets the needs of the society of which it is a part. As society changes, so must postsecondary education change. The way in which an institution is responsive to societal needs is a function, for the most part, of its sophistication in planning. As critical as comprehensive planning is to an institution, however, only a small number "have effectively developed a plan based on sound data about themselves and their setting which is revised at least annually and upon which the institution's leadership acts daily.[6]

Institutional planning for postsecondary education during the post World War II years had a focus on acquiring more resources and building facilities for the increased numbers of students resulting from the equal right demand for access to higher education. The two-year college emerged as a primary means for responding to the demand of providing equal access to a quality postsecondary education at a reasonable cost. Planning in postsecondary education during the 1960s was undertaken in response to immediate needs with minimum regard for the future. Planning tended to focus on the need to build facilities, develop new programs, and secure operating funds to accomodate the unprecendented influx of "traditional" students, persons in the 18-24 age range going to college full time to acquire competencies necessary to obtain the first job.

During the early 1970s, the influx of traditional students began to stabilize. Enrollments continued to grow but at a decreasing rate. Four primary reasons contributing to the slowing in enrollment growth were (1) end of the draft, (2) sharply rising costs of college attendance due to inflation, (3) changes in the job market for college graduates, and (4) liberalization of college rules to permit deferred admissions and "stopping out" of students in the midst of college careers.[7] The focus of planning began to shift from the planning for growth described above to "the coming of middle age" characterized by stable or declining enrollment, tight money, lowering of public confidence in postsecondary education, and steadily rising costs.[8]

Many private and public senior institutions experienced the impact of these forces on their institutions in the 1970s. As a result, several organizations launched programs relating to comprehensive institutional planning. The Council for the Advancement of Small Colleges conducted an Institutional Research and Planning Project (1972-75), the Planning, and Data System Project (1975-83), and the Institutional Development Project (1976-80).[9] As a result

COLLEGE PERSONNEL ATTITUDES AND PLANNING PRACTICES

1. ☐ Status-Quo - things are fine the way they are: the college, the programs, the teaching, the environment.
2. ☐ Incrementalism - we only have to do more or less of the same things.
3. ☐ Budgeting *is* Planning - analysis of budget in intricate detail and some selective incrementalism.
4. ☐ Anticipating Next Year's Crisis - some "pruning" of branches as awareness of selective resource allocation develops.
5. ☐ Multi-Year *Fiscal* Planning - 2 to 20 year budgets that attempt to match income and expenditures.
6. ☐ Single-Source Planning - done by the aggressive (or) intelligent (or) ambitious president, dean, or business manager. The "plan" is usually in his or her head.
7. ☐ Oligarchy Planning - the President's Cabinet, perhaps including token faculty and students, try to "look ahead" for the institution.
8. ☐ Institutional Research - the *ad hoc* collection of new analytic and planning information to make planning a little more rational.
9. ☐ Department Analysis - the development of some isolated academic and support department unit costs and productivity measures.
10. ☐ Comparative Data - moving from intra-institutional analysis to inter-institutional comparisons to "red flag" areas requiring further analysis.
11. ☐ Inter-Departmental Systems - recognition of the interdependence of departmental functions (e.g., admissions, programs, attrition).
12. ☐ Comprehensive and Comparative Data - hard and soft information available on each critical area and function, and comparative wherever possible.
13. ☐ Program Objective Concept - departmental accountability for department and institutional goal attainment, resource use, and productivity.
14. ☐ Systematic and Informed Collegial Model - broad participation in organized departmental and institutional planning process producing multi-year (5-year) budget that is reviewed annually.

William A. Shoemaker
CASC Vice President for Research
September, 1977

of these projects, William A. Shoemaker, former Vice President for Research for CASC developed a list of "College Personnel Attitudes and Planning Practices" which begins with status quo and incrementalism attitudes, moves through multi-year fiscal planning and institutional research practices, and extends to the systematic and informed collegial model.

A program conducted by John D. Millett, Executive Vice President for the Academy for Educational Development, is an elaboration of the systematic and informed collegial model. During the three calendar years 1975 through 1978, AED undertook a project to assist selected colleges and universities in the management of change. The model calls for specification of external environmental assumptions such as (1) social expectations, (2) economic trends, (3) demographic trends, and (4) governmental planning.[10]

A project by the American Association of State Colleges and Universities uses societal trends and societal values as a way of planning futures and bringing planning assumptions into focus. The project uses a cross-influence matrix of 12 societal trends and 12 values to determine goals in 10 areas. The 12 societal trends are population, government, global affairs, environment, energy, economy, science and technology, human settlements, work, life style, women and participation. The 12 societal values are change, freedom, equality, leisure, foresight, pluralism, localism, responsibility, knowledge, quality, goals, and interdependence. The 10 goal areas are finance, students, research and development, public service, facilities, faculty, curricula, administration, resources, and athletics.[11]

A recently completed doctoral dissertation about planning in two-year colleges indicates that the process has historically been characterized as ad hoc, informed, authoritative, and expansionary.[12] Conclusions about the principal characteristics of institutional planning systems are:

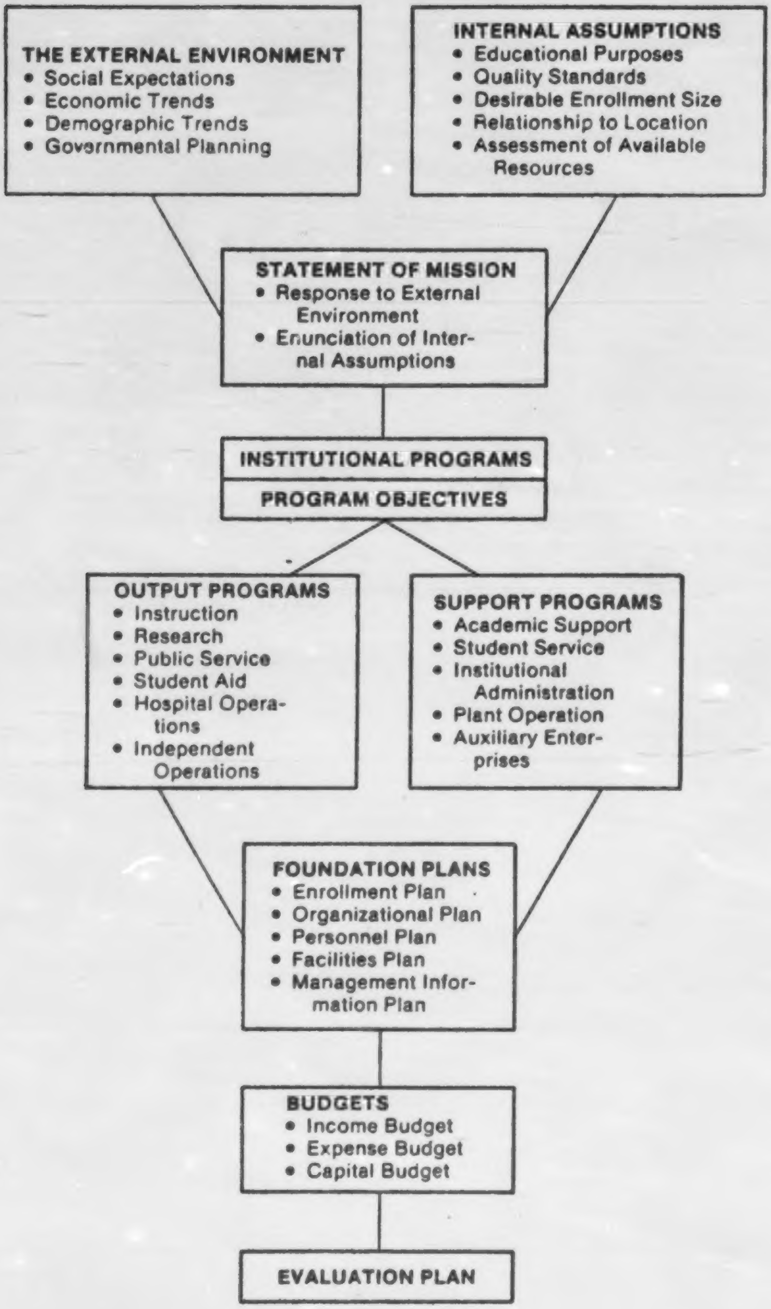
1. Planning systems are in a state of evolutionary development.
2. Planning processes are becoming more formal and structured.
3. Planning systems tend to be centrally controlled.
4. Planning systems are becoming more information based.
5. Faculty, students, and trustees are demanding greater participation in the planning process.
6. Institutional planning systems are becoming more comprehensive.
7. Planning is influenced more and more by resource considerations.
8. Planning results in a formal written plan.
9. Written plans contain some basic elements.
10. The influence of state boards and legislatures is growing.

Challenge to Management Systems

Planning processes in postsecondary education are shifting from *operations* and *project* planning to *strategic, information-based* planning models including an assessment of the external environment. In addition, these processes are shifting from almost exclusive *intramural* models to models which include something in *extramural* or *intermural* planning. These shifts are occurring in both the *voluntary cooperation* mode and in the *involuntary coordination* mode. Management information systems in the past have tended to focus on data elements relating to the internal operations of the institution such as registration, scheduling, class rosters, space utilization, grade reporting, student aid, payroll, budgeting, and other administrative applications. Data have been collected and grouped in files labeled student, personnel, financial, and space. Sometimes the data elements are similar for various reporting agencies and occasionally the independent files can be integrated to produce meaningful reports on topics such as program cost analysis and student longitudinal studies. Occasionally independent file reports or integrated file reports are synchronized with decision points in the annual planning/budgeting cycle but usually stops short of strategic planning.

Time will not permit a detailed discussion of strategic planning processes which includes how trend analysis can be incorporated in such processes in either the institutional or consortial contexts.[13] It does appear,

The Planning Process In Higher Education


THE EXTERNAL ENVIRONMENT
• Social Expectations
• Economic Trends
• Demographic Trends
• Governmental Planning
INTERNAL ASSUMPTIONS
• Educational Purposes
• Quality Standards
• Desirable Enrollment Size
• Relationship to Location
• Assessment of Available Resources
STATEMENT OF MISSION
• Response to External Environment
• Enunciation of Internal Assumptions
INSTITUTIONAL PROGRAMS
PROGRAM OBJECTIVES
OUTPUT PROGRAMS
• Instruction
• Research
• Public Service
• Student Aid
• Hospital Operations
• Independent Operations
SUPPORT PROGRAMS
• Academic Support
• Student Service
• Institutional Administration
• Plant Operation
• Auxiliary Enterprises
FOUNDATION PLANS
• Enrollment Plan
• Organizational Plan
• Personnel Plan
• Facilities Plan
• Management Information Plan
BUDGETS
• Income Budget
• Expense Budget
• Capital Budget
EVALUATION PLAN

however, that some corporate planning is at a more advanced stage than planning in postsecondary education. In 1967, the Institute of Life Insurance conducted a Future Outlook Study to assess significant social and political trends because it seemed clear that reactive styles were not appropriate in times of rapid change. One result of the Future Outlook Study was a call for an ongoing mechanism to be established by which the business could keep abreast of emerging ideas and social changes that might affect its operating environment. In 1970, an early-warning system called the Trend Analysis Program (TAP) was designed and put into place. TAP continues to operate as a program of the American Council of Life Insurance, formed in 1976 by a merger of the Institute of Life Insurance and the American Life Insurance Association.[14]

The issue of trend analysis is of such importance that the American Association of Higher Education launched a trend-awareness project in 1978 and the American Vocational Association adopted a resolution at its 1979 Convention to create a task force to develop a mechanism for determining the directions of changes in vocational education.[15]

Categories of information used in strategic planning include (1) social expectations, (2) economic trends, (3) demographic trends, (4) governmental planning, (5) technological advances, (6) changes in the workplace, (7) energy requirements, and (8) value shifts. An example that cuts across several of these categories and touches each one of us is health care. The Hospital Survey and Construction Act of 1946 was one of the first major efforts to bring a rational and systematic planning focus to health delivery system. For the past thirty plus years there has been continual refinement in the federal legislation planning requirements relative to health care and education. The "Health Planning and Resource Development Act of 1964" (P.L. 93-641 and P.L. 96-79 in 1979) charges this nation's 210 Health Systems Agencies to collect and analyze data in order to respond to the social expectation of equal access to quality health care services for all persons at a reasonable cost. As a result, the HSAs have collected and analyzed mountains of data about the health status of persons and the health care delivery system in each of the 210 geographic districts and aggregated at state levels. A Board of Trustees, the majority of which are consumers, for each HSA interpret these data and set forth long range goals, objectives, and recommended actions to meet identified problems and concerns. This Health Systems Plan serves as a guide for the enhancement of the population's health status, the development of the area's health resources, and the education and involvement of the general public in matters pertaining to health and health care. The PSP also provides the basis for the Board of Trustee's review of proposed health systems changes, the provision of technical assistance and the development of an Annual Implementation Plan which establishes short range objectives to be achieved in a given fiscal year.

The impact of social expectations for better and more economic health care, as translated in federal regulation, upon the management systems of universities with teaching hospitals is quite clear.[16] Data will be required about human, equipment, and fiscal resources necessary to justify any additional expenditure in a "certificate of need" application. Under "appropriateness review," areas to be examined "shall at least consider the need for the service, its accessibility and availability, financial viability, cost effectiveness, and the quality of service provided.[17] The categories of services to be reviewed include psychiatric, mental health, alcoholism, and home health along with primary, secondary, and tertiary institutional care categories such as radiation therapy, open heart surgery, and others.[18] By now it should be quite clear that these governmental regulations have implications for each institution, the strategic planning function and management system, that has programs to prepare persons for careers in the medical health, and human service occupations.

Health manpower, however, is not the only area worthy of examination. Changes in the workplace and trends in worker dissatisfaction,[19] productivity,[20] worker underutilization,[21] and investment in research and development[22] are worthy of our analysis, as is a discussion of the rights movement. The social expectation of the right to work carries with it the right to training. In a recent issue of Education Update, the AFL-CIO indicated that "One of the most pressing problems in labor education is to determine educational needs of union members.[23] At the first Business-Higher Education Forum conducted by the American Council on Education it was concluded that "Universities and colleges lack sensitivity to the product and manpower needs of industry and business."[24] This weakness was stated by the head of the American Association of Community and Junior College as follows:[25]

> An awareness of the needs of persons in the college area requires a stance unfortunately sometimes lacking in educators or provided for in institutional structures. One of the biggest problems facing education may be a reluctance (or inability) for people in education to relate on a regular basis with people in business, industry, the unions, and agriculture. A note sounded repeatedly as one talks with people about educational needs is that they perceive schools and colleges as 'self-contained enclaves of educators'.

Kenneth E. Boulding suggests we are moving "Toward a Vintage Society."[26] He writes:

> The maturation of our society, for good or for ill, will dominate change during the next decades. In biological organisms, senescence or death is inevitable when the biological potential of the original cell is exausted. This does not have to happen in social organizations, or even total societies, because these structures are capable of a kind of social recombinant DNA. One sure sign of impending death for an organization or society is a fixed, uncritical worship of old ideas and ways that prevents adjustment to new situations. A society can restore its potential by replacing the old with the young in role structures and by developing "visions," renewals, and expansions of its original ideas.

FOOTNOTES

[1] Oscar N. Serbein, Educational Activities of Business (Washington, D.C.: American Council on Education, 1961).

[2] Carolyne Davies and Austin Dougherty, "Our 14,000 Colleagues in Business, Industry and Government," AAHE Bulletin, October 1978, p. 7.

[3] Stan Luxenberg, "Business Is Big In Education Too," The New-York Times, January 7, 1979, Section 13, p. 15.

[4] Robert J. Kost, "Competition and Innovation in Continuing Education," Training and Development Journal, May 1980, pp. 48-67.

[5] AAHE Bulletin (Washington: American Association of Higher Education, October 1980) p. 11.

[6] L. Richard Meeth, Quality Education for Less Money (San Francisco: Jossey-Bass, Inc., 1974), p. 2.

[7] Carnegie Foundation for the Advancement of Teaching, More Than Survival (San Francisco: Jossey-Bass, Inc, 1975), p. 31.

[8] Earl F. Cheit, "The Coming of Middle Age in Higher Education," Address to Joint Session of the American Association of State Colleges and the National Association of State Universities and Land Grant Colleges, November 13, 1972, Washington, D.C.

[9] The first of these three projects was supported at $1 million and established an Office of Institutional Research at 15 CASC colleges; many of these colleges now have comprehensive institutional planning processes. This project indicated the need to develop management tools. The Planning and Data System Project initial phase, 1975-77, developed management tools in 11 areas: college goals and climate, student recruitment, student financial aid, student attrition, instructional program analysis, faculty activity, library costs and services, personnel and compensation, fund raising, a marketing approach to program development, and student learning outcomes. A second phase started in 1977 included the dissemination of these tools for data collection and analysis and for generation of comparable data for the small college in the first nine areas listed above. The Carnegie Corporation supported a third phase for $198,000 to support expansion of the data bases for the individual PDS modules and the preparation of a comprehensive planning manual. This phase should be completed by 1983 and brings total Carnegie support for the project to $792,400. The Institutional Development Project provided technical assistance to approximately 50 colleges in (1) planning, research and evaluation; (2) enrollment, development, retention, and financial aid; (3) program development - academic and student services; (4) college personnel management and development; and (5) financial resources management and development. The project provided each college an opportunity to diagnose where it was in the developmental sequence and obtain technical assistance in these areas. It represented a way of reducing the lag between R and D and implementation of new knowledge as it relates to institutional development.

[10] John D. Millett, Higher Education Planning: A Report of Experience and A Forecast of Strategies for Change (Washington, D.C.: Academy for Educational Development, 1978).

[11] A Futures Creating Paradigm: A Guide To Long-Range Planning From the Future For The Future (American Association of State Colleges and Universities, Resource Center for Planned Change, 1978).

[12] Steven LeRoy Van Ausdle, Comprehensive Institutional Planning Systems in Selected Two-Year Colleges (Columbus: The Ohio State University, 1980).

[13] Warren H. Groff and Robert B. Fox, "Data as an Institutional Resource in a Planning, Management, and Evaluation System", a paper presented at College and University Systems Exchange, December 15, 1978. (Published in Proceedings and July 1979 issue of CAUSE/EFFECT).

Warren H. Groff and Robert B. Fox, "Key Data Elements in a Planning, Management and Evaluation Syllogistical Mode," a paper presented at the 25th Annual College and University Machine Records Conference, May 4-7, 1980. (Published in 1980 Conference Proceedings).

Warren H. Groff, "Trend Analysis As A Component of Comprehensive Institutional Planning", a paper presented at the workshop on Comprehensive Institutional Planning sponsored by the National Alliance of Postsecondary Education Institutions/Districts of the National Center for Research in Vocational Education, September 14-15, 1980.

Warren H. Groff, "Environmental Trend Analysis and Strategic Decision Making: A New Role for Collegiate Cooperation," a paper presented at the Council for Interinstitutional Leadership, Greater Cincinnati Consortium of Colleges and Universities, October 26-28, 1980.

[14] AAHE Bulletin, November 1978, p. 11.

Update, January 1980, p. 16.

[15] How TAP Works (Washington, D.C.: American Council of Life Insurance, 1978). TAP has produced reports on Aging and the Aged; The Employee; The Life Cycle; The International Scene; Frontier Technologies: Part One - Science and Health; Frontier Technologies: Part Two - Information Science; A Culture in Transformation: Toward A Different Societal Ethic; Transportation; Changing Residential Patterns and Housing; Planning; Death, Dying and Life Extension; and The Changing Nature of Work.

[16] Changes in the amendments of 1979 extend "certificate of need" reviews to include major medical equipment and institutional health services and capital expenditures.

[17] P.L. 96-79, Sec. 118 (a) (2) (b) (1) Section 1513 (g) (3).

[18] The schedule for appropriateness review in Ohio is as follows: Radiation Therapy, Open Heart, Cardiac Catheterization, Emergency Room, Computed Tomography, Obstetric, Neonatal, Pediatric, Psychiatric, Mental Health, Long Term Care, Alcoholism, General Acute Care, Home Health, End Stage Renal disease.

[19] "New Breed of Workers," U.S. News and World Report, September 3, 1979, pp. 35-38. Daniel Yanekelvich, "The New Psychological Contracts at Work," Psychology Today, May 1978, pp. 46-53.

[20] "The Productivity Pinch," Time, August 27, 1979, p. 36. Productivity in the Changing World of the 1980s: The Final Report of the National Center for Productivity and Quality of Working Life, 1978. Work in America: The Decade Ahead, Work in America Institute Series, 1979.

[21] "Changing Employee Values: Deepening Discontent?", Harvard Business Review, January-February, 1979.

[22] National Patterns of R & D Resources: Funds and Personnel in the United States (Washington, D.C.: Superintendent of Documents). "The Sad State of Innovation," Times, October 22, 1979, pp. 70-71.

[23] Education Update, September 1979, p. 5.

[24] T. M. Stauffer, "Summary of The First Meeting, Business-Higher Education Forum" (Washington: American Council on Education, January 26-27, 1979).

[25] Edmund J. Gleazer, Jr., The Community College: Values, Vision, and Vitality (Washington, D.C.: American Association of Community and Junior Colleges, 1980), p. 6.

[26] Kenneth E. Boulding, "Toward a Vintage Society, "Technology Review, August/September, 1980, pp. 4-5.

ALLOCATION OF RESOURCES TO COMPUTER SUPPORT IN TWO-YEAR COLLEGES

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I. INTRODUCTION

A. PURPOSE

This paper is the result of an intensive year-long effort to develop, for the first time, data on levels of computer-related expenditures for two-year colleges across the nation. Many studies have been conducted of various aspects of college computer operations. In most instances, however, the results of such surveys have not been susceptible to statistical aggregation and analysis. In consequence, it has usually not been possible to meaningfully relate their findings to the experience of individual institutions in any really satisfactory way. The result has often been a plethora of data--useful in one or another degree for the purposes for which they were gathered--but lacking inter-institutional comparability. It has seldom been possible to answer the fundamental question of how an institution stands vis-a-vis its peers in regard to allocation of resources to the computer function.

The study reported on here has plowed new ground in seeking simple, comparable data on computer costs. Severe discipline in regard to the definition of the data selected for collection, aggregation, and analysis has yielded such simple but meaningful information on computer-related expenditures in relation to total college expenditures and to credit student headcount. This is a case where less is more. The extremely constrained request for data has yielded more useful and meaningful results than has any such study conducted previously.

The central purpose of this paper is to provide answers to the eternal question in regard to computer expenditures: how do allocations of resources to the computer function for one's own institution compare with those for other comparable two-year institutions? The payoff from the study comes from comparing expenditure levels for a given institution with the array of such data for institutions of similar size. Such comparisons do not tell an institution whether it is spending too much or too little or whether it is spending wisely or not. But they do tell an institution something it has not previously been able to ascertain. This is whether the institution's computer-related expenditures--as a percentage of total operating expenditures and in dollars per credit headcount student--are high, medium, or low relative to expenditures of other similarly sized institutions.

This study also provides these data not alone for basic computer operating expenditures but also for the sum of these "normal" costs plus annual equipment lease costs and those major developmental and capital costs periodically incurred by most institutions. Finally, it displays the breakdown of computer operating expenditures between administratively-related and academically-related support as well as the proportions that each of these latter two categories are of the total.

The results should help boards and administrations evaluate the extent to which their own experience represents where they believe they are and where they want to be in regard to resources allocated to computer support to their administrative and academic programs and processes.

B. METHODOLOGY

The study's basic methodology included the following steps:

- Following proposal and endorsement of the basic study effort by the NACUBO Two-Year Colleges Committee, a study design was developed, reviewed with staff of NACUBO and CAUSE, and confirmed.
- A mailing list and mailing labels addressed to chief financial/business officers were provided by CAUSE for 999 institutions of the some 1,234 two-year institutions; included were all institutions for which CAUSE files showed names and addresses of chief financial/business officers.
- A questionnaire was developed, reviewed by NACUBO and CAUSE staff, and forwarded over the signature of D. F. Finn, Executive Director of NACUBO, with a request for cooperation to each of the 999 chief business/financial officers.
- The questionnaires were returned to Cuyahoga Community College (CCC), Cleveland, Ohio, which had volunteered to undertake and contribute the programming, processing, and analytical effort.
- CCC developed the programming and conducted test runs on the first returns. CCC also audited all returns, developing a computerized questionnaire audit program for this purpose.
- Some 376 questionnaires were ultimately received. Every effort was then made to verify questionable data, mainly through telephone callbacks to individual institutions.
- Based on the audited and corrected computer printouts of data, the results for the remaining 308 useful responses were analyzed, and a monograph was drafted, reviewed and edited by NACUBO staff, and is about to be published.

C. RELIABILITY OF STUDY DATA

In reviewing these data it should be borne in mind that it is probable that:

- Actual values at the percentiles shown for the category 0-1000 credit headcount students should be slightly lower than shown due to under reporting of some institutions with no computer expenditures.
- Actual values at the percentiles shown for the categories of 5001-15000 and, especially, of over 15,000 credit headcount students probably should be somewhat higher than shown due to likely underreporting of some computer expenditures incurred in decentralized organization units and budgets.
- Allocations of "normal" computer operating expenditures between administrative and academic support typically reflect judgment

based on utilization of one of several possible bases for such allocation.

The compelling virtue of this study is that it deals only with major concepts: e.g., headcount, total college operating expenditures, total computer operating expenditures, and the overall breakdown of costs between administrative support and academic support; these "big" numbers are those figures that institutions are able to provide with greatest reliability. In addition, the survey response ratio was extremely high, i.e., one in three, and the number of institutions in each size cell is, statistically speaking, very satisfactory. Although perfectly precise data from all 1,234 two-year colleges would vary from those reported herein, it seems evident that the difference between the two sets of numbers could be expected, percentagewise, to be quite small.

The overall conclusion as to reliability is that this study has produced essentially valid results and that the data may be used for purposes of comparison with the experience of one's own institution with a relatively high degree of confidence.

II. STUDY DESIGN

First, the basic study design developed comparative data of two major types, as follows:.

- Computer expenditures in relation to college total operating expenditures.
- Computer expenditures in relation to college credit student headcount.

Second, within each of these two categories, five sets of data are presented--i.e., for all institutions and for each of the four peer category size groupings--as follows:

- All institutions.
- Institutions with up to 1,000 credit student headcount.
- Institutions with 1,001 to 5,000 credit student headcount.
- Institutions with 5,001 to 15,000 credit student headcount.
- Institutions with over 15,000 credit student headcount.

Third, for each of these five institutional groupings, data are provided for five percentiles, as follows:

- The 12.5th percentile, which indicates the modal figure for the first, or lowest, quarter of responses in the array of institutions.

- The 37.5th percentile, which indicates the modal figure for the second quarter of responses in the array.

- The 50th percentile, which indicates the median figure for all institutions in the array, i.e., a value whose characteristic is such that as many responses are below as are above it.

- The 62.5th percentile, which indicates the modal figure for the third quarter of responses in the array.

- The 87.5th percentile, which indicates the modal figure for the fourth or highest quarter of responses in the array.

Fourth, these matrices are then used to define and express the substantive survey data, i.e., (1) various categories of computer expenditures as percentages of total college operating expenditures, (2) various categories of computer expenditures per credit headcount student, and (3) academic and administrative computer expenditures as percentages of "normal" computer operating expenditures.

Four sets of computer expenditures are calculated in the NACUBO-published study for comparison with college total operating expenditures and with credit student headcount but only two of these are presented in this paper:

- First is "normal" computer operating expenditures, i.e., the ongoing operating costs of a college's computer function.

- Second is the sum of (1) these "normal" computer operating expenditures plus (2) ongoing lease expenditures, computer development expenditures, and computer capital purchase expenditures. This sum totals all computer-related outlays by the institution for the year, both "ongoing" and "one-shot".

In addition "normal" computer operating expenditures allocated to academic and to administrative costs are calculated for comparison with the total of such "normal" computer operating expenditures and with credit student headcount.

Fifth, study findings are for several reasons based on headcount statistics. These are the standard enrollment statistics reported to and by the AACJC. They do not require special rules for translation into FTES. They are a suitable basis for a sort of institutions by size for purposes of this analysis. In addition, many categories of computer expenditures--e.g., for such student services as enrollment, student billing, and grade recording--vary more directly in proportion to student headcount than to some theoretically-calculated full-time equivalent student value.

Sixth, institutions were requested to supply data for their most recent 12-month accounting period and, in the great bulk of cases, did so for the 1979-1980 year.

III. FINDINGS

A. COMPARISON OF KEY FINDINGS AMONG PEER CATEGORY SIZE GROUPINGS

Following is a summary of key findings among institutional groupings.

1. Computer Expenditures as Percent of Total College Operating Expenditures

Table 1. "Normal" Computer Operating Expenditures as Percent of College Total Operating Expenditures

	No. in Sample	Percentiles 12.5th	37.5th	50th	62.5th	87.5th
Total	308	0.3%	1.4%	1.9%	2.4%	4.2%
0 - 1,000	45	0.0%	0.1%	0.2%	0.6%	2.9%
1,001 - 5,000	146	0.4%	1.4%	1.9%	2.2%	3.8%
5,001 - 15,000	79	0.9%	1.9%	2.4%	3.0%	4.6%
Over 15,000	38	1.0%	2.0%	2.1%	2.8%	4.9%

- In general, the proportion of college total operating expenditures spent for "normal" computer operating expenditures increased with size of institutions.

- Median (or 50th percentile) figures for "normal" computer expenditures ranged from 0.2% for the 0 - 1,000 size institution to 2.4% for the 5,001 - 15,000 student group and 2.1% for the over 15,000 group. Modal figures for the upper quarter ranged from 2.9% to 4.9%.

Table 2. Total Computer-Related Expenditures as Percent of College Total Operating Expenditures

	No. in Sample	Percentiles 12.5th	37.5th	50th	62.5th	87.5th
Total	308	0.6%	2.2%	2.7%	3.5%	6.4%
0 - 1,000	45	0.0%	0.1%	0.6%	0.8%	4.4%
1,001 - 5,000	146	1.0%	2.0%	2.4%	3.1%	5.9%
5,001 - 15,000	79	1.3%	2.9%	3.5%	4.2%	6.8%
Over 15,000	38	1.5%	2.9%	3.6%	4.2%	8.6%

- Median figures for total computer-related expenditures ranged from 0.6% for the smallest institutions to 3.6% for the largest. Modal figures for the upper quartile ranged from 4.4% to 8.6% respectively.

- While not shown here, for the 308 institutions as a whole and for the three larger size groups, about a third of "normal" computer operating expenditures for the median institutions were for academic support and about two-thirds for administrative support

2. Computer Expenditures Per Credit Headcount Student

Table 3. "Normal" Computer Operating Expenditures Per Credit Headcount Student

	No. in Sample	Percentiles 12.5th	37.5th	50th	62.5th	87.5th
Total	308	$ 5	$20	$27	$33	$62
0 - 1,000	45	0	3	6	11	90
1,001 - 5,000	146	6	22	29	35	60
5,001 - 15,000	79	10	22	29	33	54
Over 15,000	38	7	21	26	29	44

- For the three larger institutional categories, "normal" computer operating expenditures ranged at the medians from $26 to $29 per credit headcount student, $29 to $35 per student as the modal figures for the third quarter, and $44 to $60 per student as the modal figures for the upper quarter.

Table 4. Total Computer-Related Expenditures Per Credit Headcount Student

	No. in Sample	Percentiles 12.5th	37.5th	50th	62.5th	87.5th
Total	308	$ 7	$30	$38	$49	$103
0 - 1,000	45	0	3	9	39	150
1,001 - 5,000	146	12	30	38	49	97
5,001 - 15,000	79	10	33	41	47	89
Over 15,000	38	12	31	39	49	79

- Per student expenditures for total computer-related costs for the three larger categories of institutions ranged at the median from $38 to $41 per student, $47 to $49 as the modal figures for the third quarter, and $79 to $97 as the modal figures for the upper quarter.

- These two tables thus show that while expenditures per student were much less for the 0-1,000 student institutions than for the larger categories, experience did not differ greatly among the three larger categories for most percentiles reported on.

3. College Total Operating Expenditures Per Credit Headcount Student

Tables 1 and 2 above indicated that computer expenditures as a percent of college total operating expenditures increased substantially as size of peer group increased. Tables 3 and 4 indicated that computer expenditures among the three larger peer groups of institutions were more or less similar per credit headcount student. The explanation for this is necessarily found in college total operating expenditures per student that on the average decreased with increasing size of institutional peer groups. This progression is shown below.

Table 5. College Total Operating Expenditures Per Credit Headcount Student

	No. in Sample	Percentiles				
		12.5th	37.5th	50th	62.5th	87.5th
Total	308	$ 893	$1,243	$1,473	$1,780	$2,807
0 - 1,000	45	1,732	2,443	2,977	3,569	4,593
1,001 - 5,000	146	1,038	1,421	1,708	1,906	2,458
5,001 - 15,000	79	843	1,062	1,147	1,254	1,600
Over 15,000	38	644	915	993	1,111	1,484

As this table indicates, per credit headcount student costs in all percentile categories declined significantly for each successively larger group of institutions. The principal reason for this appears to be that, on the average, the larger the institution, the higher the ratio of credit headcount students to full-time equivalent students (i.e., the larger the percentage of students taking only a few credits)--and thus the lower the level of college total operating costs per headcount student. As probably a lesser factor, the smaller institutions include a higher percentage of private institutions with considerably higher budgets relative to student numbers than do the larger categories. It is believed that calculations based on full-time equivalent student numbers would tend to show computer costs per headcount student increasing with peer group size as do computer-related expenditures as percentages of college total operating expenditures.

B. COMPARISON OF KEY FINDINGS WITHIN PEER CATEGORY SIZE GROUPINGS

This section reports on categories of computer expenditures in relation to college total operating expenditures and to credit student headcount. Selected survey results are analyzed first for all 308 institutions and then for each size peer group. Two tables are presented in each sub-section.

- The first table summarizes the key findings for four ratios relating to college total operating expenditures, as follows:
  - First, "normal" computer operating expenditures as a percent of college total operating expenditures.
  - Second, total computer-related expenditures as a percent of college total operating expenditures.

- Third, academic program computer support as a percent of "normal" computer operating expenditures.

- Fourth, administrative program computer support as a percent of "normal" computer operating expenditures.

- The second table in each sub-section summarizes per credit headcount student expenditures for these same four categories of computer expenditures.

1. Category I: All 308 Reporting Institutions in the Sample

As noted earlier, some 308 institutions provided valid and usable responses to this survey.

Table 6. Computer Expenditures as Percent of College Total Operating Expenditures and Allocation between Academic and Administrative Support--All 308 Institutions

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	0.3%	1.4%	1.9%	2.4%	4.2%
Total Computer Costs	0.6%	2.2%	2.7%	3.5%	6.4%
Academic Costs*	0.0%	20.0%	30.0%	40.0%	63.0%
Administrative Costs*	20.8%	52.8%	64.0%	74.1%	98.2%

- For all 308 participating institutions the median experience was "normal" computer operating expenditures at 1.9% of college total operating expenditures and all computer-related expenditures at 2.7%. Modal figures for the upper quarter of all institutions were 4.2% and 6.4%, respectively.**

- The median experience showed 30% of "normal" computer operating expenditures for academic support and 64% for administrative support. Modal figures for the upper quarter were 63% and 98.2%, respectively respectively.

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*With regard to the last two rows of percentage statistics in this and subsequent similar tables, because each statistic has a different institution at its percentile value, proportions do not add to 100%.

**Comparisons in the text are made with the median experience for the entire group as the most representative figures available. Comparisons are also made with the modal figure for the upper quarter of institutions on the assumption that readers of this report will be particularly interested in the experience of colleges whose expenditure ratios indicate a major commitment for utilization of the computer in the work of the institution.

Table 7 - Computer Expenditures Per Credit Headcount Student--All 308 Institutions

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	$ 5	$ 20	$ 27	$ 33	$ 62
Total Computer Costs	7	30	38	49	103
Academic Costs*	0	4	7	10	25
Administrative Costs*	2	12	15	20	44

- The median experience for "normal" computer operating expenditures was $27 per credit headcount student and $38 for total computer-related expenditures. Modal figures for the upper quarter were $62 and $103, respectively.

- Medians for "normal" computer operating expenditures per credit headcount student were $7 for academic support and $15 for administrative support. The comparable modal data for the upper quarter of institutional experience were $25 and $44 per student, respectively.

2. Category II: Institutions with Credit Headcount Enrollment of 0 - 1,000 Students

Some 45 institutions of up to 1,000 students provided useful results. A number of very small institutions reported that they had no computer-related expenditures. Those with no computer-related expenditures that also reported total operating expenditures were included in these statistics as valid data elements while those that did not do so necessarily were excluded. As a result, the number of institutions reported on in the lower end of the array for this size group category is understated in relation to the total of responses received, and all percentile values reported are, consequently, somewhat overstated.

Table 8. Computer Expenditures as Percent of College Total Operating Expenditures and Allocation between Academic and Administrative Support--0 - 1,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	0.0%	0.1%	0.2%	0.6%	2.9%
Total Computer Costs	0.0%	0.1%	0.6%	0.8%	4.4%
Academic Costs	0.0%	0.0%	0.0%	13.0%	60.0%
Administrative Costs	0.0%	25.0%	64.0%	76.8%	100.0%

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*The last two rows of dollar statistics in this and subsequent similar tables will typically not add to the dollar values in the first row because each statistic has a different institution at its percentile value.

- Medians for "normal" computer operating expenditures were 0.2% of college total operating expenditures and for total computer-related expenditures were 0.6%. Modal results for the upper quarter were 2.9% and 4.4%, respectively.

  The median experience showed 0% of the "normal" computer operating expenditures for academic support and 64.0% for administrative support. Modal figures for the upper quarter were 60% and 100%, respectively.

Table 9 - Computer Expenditures Per Credit Headcount Student-- 0 - 1,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	$ 0	$ 3	$ 6	$ 11	$ 90
Total Computer Costs	0	3	9	39	150
Academic Costs	0	0	0	2	19
Administrative Costs	0	1	4	9	57

- For the median institution, "normal" computer operating expenditures per credit headcount student were $6 and total computer-related expenditures were $9. Modal experience for the upper quarter of institutions was $90 and $150, respectively.

- Medians for "normal" computer operating expenditures per credit headcount student were $0 for academic support and $4 for administrative support. Comparable data for the upper quarter were $19 and $57 per student, respectively.

3. Category III: Institutions with Credit Headcount Enrollment of 1,001 - 5,000 Students

Some 146 institutions reported in this size category.

Table 10. Computer Expenditures as Percent of College Total Operating Expenditures and Allocation between Academic and Administrative Support--1,001 - 5,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	0.4%	1.4%	1.9%	2.2%	3.8%
Total Computer Costs	1.0%	2.0%	2.4%	3.1%	5.9%
Academic Costs	0.0%	20.0%	33.1%	41.3%	67.8%
Administrative Costs	23.4%	49.7%	60.3%	71.8%	100.0%

- Medians for "normal" computer operating expenditures were 1.9% of college total operating expenditures and 2.4% for total computer-related expenditures. Modal data for the upper quarter were 3.8% and 5.9%, respectively.

- The median figures were 33.1% of total "normal" computer operating expenditures for academic support and 60.3% for administrative support. Modal data for the upper quarter were 67.8% and 100%, respectively.

Table 11. Computer Expenditures Per Credit Headcount Student--1,001 - 5,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	$ 6	$ 22	$ 29	$ 35	$ 60
Total Computer Costs	12	30	38	49	97
Academic Costs	0	4	8	12	27
Administrative Costs	3	12	15	20	38

- The median institutions spent $29 per credit headcount student for "normal" computer operating expenditures and $38 for total computer-related expenditures. Modal data for the upper quarter were $60 and $97, respectively.

- The median figures were $8 per student for "normal" computer operating expenditures for academic support and $15 per credit headcount student for total computer-related expenditures. Modal figures for the upper quarter were $27 and $38 per student, respectively.

4. Category IV: Institutions with Credit Headcount Enrollment of 5,001 - 15,000 Students

Some 79 institutions provided responses in this size category.

Table 12. Computer Expenditures as Percent of College Total Operating Expenditures and Allocation Between Academic and Administrative Support--5,001 - 15,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	0.9%	1.9%	2.4%	3.0%	4.6%
Total Computer Costs	1.3%	2.9%	3.5%	4.2%	6.8%
Academic Costs	8.3%	28.0%	34.9%	44.1%	60.0%
Administrative Costs	37.5%	51.2%	60.5%	70.7%	89.5%

This and the over 15,000 student categories of institutions spent higher percentages of their budgets for computer services than did the 0 - 1,000 and 1,001-5,000 credit student headcount groups.

- The median institution spent 2.4% of college total operating expenditures for "normal" computer operating expenditures and 3.5% for total computer-related expenditures. Modal figures for the upper quarter were 4.6% and 6.8%, respectively.

- The median institutions spent 34.9% of "normal" computer operating expenditures for academic support and 60.5% for administrative support. Modal figures for the upper quarter were 60% and 89.5%, respectively.

Table 13 - Computer Expenditures Per Credit Headcount Student--5,001 - 15,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	$ 10	$ 22	$ 29	$ 33	$ 54
Total Computer Costs	10	33	41	47	89
Academic Costs	2	6	7	10	22
Administrative Costs	4	14	16	22	37

- The median institutions spent $29 per credit headcount student for "normal" computer operating expenditures and $41 for total computer-related expenditures. Modal figures for the upper quarter were $54 and $89, respectively.

- The median figures for "normal" computer operating expenditures were $7 per student for academic support and $16 for administrative support. Comparable modal figures for the upper quarter were $22 and $37, respectively.

5. Category V: Institutions with Credit Headcount Enrollment of Over 15,000 Students

Some 38 institutions reported in this largest size category.

Table 14 - Computer Expenditures as Percent of College Total Operating Expenditures and Allocation between Academic and Administrative Support--Over 15,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	1.0%	2.0%	2.1%	2.8	4.9%
Total Computer Costs	1.1%	2.4%	2.7%	3.6%	6.0%
Academic Costs	4.8%	20.0%	29.4%	36.0%	50.0%
Administrative Costs	48.3%	60.4%	70.0%	75.0%	92.5%

- The median institutions spent 2.1% of college total operating expenditures for "normal" computer operating expenditures and 2.7% for total computer-related expenditures. Modal figures for the upper quarter were 4.9% and 6.0%, respectively.

- The median figures were 29.4% of "normal" computer operating expenditures for academic support and 70% for administrative support. Modal figures for the upper quarter were 50% and 92.5%, respectively.

Table 15. Computer Expenditures Per Credit Headcount Student--Over 15,000 Student Category

	Percentiles				
	12.5th	37.5th	50th	62.5th	87.5th
Computer Operations	$ 7	$ 21	$ 26	$ 29	$ 44
Total Computer Costs	12	31	39	49	79
Academic Costs	1	3	6	9	14
Administrative Costs	5	13	14	20	44

- The medians of these largest institutions spent $26 per credit headcount student for "normal" computer operating expenditures and $39 for total computer-related expenditures. Modal figures for the upper quarter were $44 and $79, respectively.

- The median figures for "normal" computer operating expenditures were $6 per student for academic support and $14 for administrative support. Modal figures for the upper quarter of this group were $14 and $44, respectively.

* * * * *

This paper has summarized the results of the "first-ever" study of nationwide experienced "norms" of the allocations by two-year colleges of resources to the computer function. It is hoped that the results will prove useful both to the two-year colleges and to the broader higher education constituency. NACUBO is already underway in repeating this study for the current year.

TRACK II
MANAGING THE INFORMATION SYSTEMS RESOURCE

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Personnel Retention in the College and University Information Systems Environment

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How are colleges and universities going to recruit and retain quality analysis and programming personnel in the future? Beset on the one side by institutional cost pressures, and on the other by a thriving market for computer-related talent, institutions are finding themselves with special challenges to the productivity of their computer services. This presentation concentrates on the circumstances and problems of personnel turnover. Some practical responses available to institutional administrations are described and illustrated.

Personnel Retention in the College and University Information Systems Environment

Colleges and universities face increasing pressures to provide better services to their constituencies even as resources are increasingly limited. That statement is one with which most people in higher education agree. But we aren't agreed on which solutions are appropriate for dealing with these pressures. Most of us who are involved in computer services in higher education hold that computerized systems offer the potential to increase responsiveness and provide the individualization which new conditions force upon us. Computerized systems also have the potential to provide greater accuracy and to effect cost savings. I believe the key to fulfilling this potential (and benefiting our institutions in critical ways) is in how the information systems resource is managed; in particular, in how the people who make up that resource are managed. Without identification, recruitment, motivation, and retention of the proper people, none of the potential for meeting the challenges of the 80's can be met. Although each of these is extraordinarily important, in order to limit the scope of this paper, "retention" will be discussed, with particular care to the problem of personnel turnover in the computer services area.

Definition of Turnover

What, exactly, is "turnover"? Turnover is the metric most frequently used to measure personnel retention; a high turnover rate ordinarily means that there is some failure in the retention policies of the organization. Turnover is measured as a percentage; usually it is the percentage of an organization which has had to be replaced during the past year. A turnover rate of 25% means that 25% of the people in a given organization left within the past year. In an attempt to standardize the term "turnover," let us note that the U.S. Bureau of Labor Statistics measures separation turnover as follows:

1) Compute the average number of employees in the reporting period by adding together the number on payroll on the first and last days of the period and dividing by two.
2) Divide the total number of separations (terminations) during the period by this average employment figure.
3) Multiply this figure by 100 to get the percentage. [1]

Turnover can be overstated by trying to annualize the percentage. ("We had 100% turnover last month. At an annual level, that means 1200%." The first statement is dramatic; the second, nonsensical.) Turnover can be understated by trying to specify "controllable" turnover. (The trouble is that classification of the reasons for turnover is highly subjective and the reasons themselves may be obfuscating.)

Problems Turnover Causes

What problems does turnover cause the afflicted organization? The biggest problem, in a data processing organization, is retraining. There are no standard work units in data processing as there is in a factory. The consequence is that most computing organizations with high turnover run at low efficiency. Not only is the new person having to absorb new and complicated systems and procedures, but that person is more prone to make damaging mistakes. Furthermore, a new person detracts from productive time spent by peers because they are having to help the new person. Although these are universal problems throughout the information systems organization, these concerns are less damaging to the operations staff than they are to the systems staff. In the latter case, it is very common for even an experienced programmer to fail to do anything productive for six months on a new, complex job.

So turnover costs time for retraining. That time becomes propagated into missed deadlines and failed opportunities to aid in solving administrative problems. Turnover is costly, in time, in effort, and in dollars. All data processing managers will attest to the increased costs of recruiting in today's atmosphere of poor supply and high demand for computing positions. More and broader advertisement has to be made in order to get responses which were common two or three years ago. And one of the most frustrating things about this increased cost, time, and effort is that the rest of the higher education faculty and staff and administrative manning equation looks entirely different. In that equation, the number of applicants is usually large, even with meager advertising.

Even though costs might appear to be the most dramatic set of problems, the most pernicious effect of high turnover is in staff morale. Intuition tells us that high turnover means that we are failing to supply job satisfaction to those people who leave. In fact, research studies show that "workers who have relatively low levels of job satisfaction are the most likely to quit their jobs and that organizational units with the lowest average satisfaction levels tend to have the highest turnover rates." [2] Frequently, the remaining staff has to shoulder a heavier load because someone has left for "greener pastures." It is small wonder that the resulting discouragement causes those same green pastures to look extremely inviting!

Causes of High Turnover

What are the causes of high turnover? There are basically seven kinds of reasons which contribute to employee turnover:

1) Supply and Demand. Financial analysts use the term "churning" to describe frenetic activity in a portfolio--buying and selling with little net gain because the cost of transactions erodes any profits. There is some evidence that "churning" is also occurring in data processing occupations, especially those in the professional categories. The excitement of a dynamic field itself causes more and more discussion centered around new opportunity. But it is also true that many employees and others who stand to profit are encouraging increasing talk of low supply and high demand. The trade publications are full of articles about turnover, and recruitment agencies have seldom been as active as they are now. In fact, despite the sluggish recessionary state of the national economy, data processing people seem to be immune from any perception of caution. A recent survey [3] noted that 80% of all computer professionals would change jobs if the opportunity arose, regardless of economic conditions.

2) Money. Because it is a socially-acceptable reason, "more money" is the usual reason given for someone leaving a given situation. And yet, anyone who has studied the mixed record of money as a motivator knows that dissatisfaction over money is often a masking emotion. In Frederick Herzberg's theories [4] , money is called a "hygiene factor," capable of causing discontent, but not capable of causing motivated performance. A poor money situation, in other words, could be the catalyst for looking elsewhere but a good money situation is neither reason alone for staying nor for going. R. A. McLaughlin, in a definitive article in Datamation [5] defines "salary compression" as a cause for leaving by noting that "...an employee who has worked somewhere for three years may find that he is earning the same as Joe College with zero experience. We know what the veteran is likely to do: add his number to the turnover statistics." Employers in higher education are particularly afflicted by "salary compression"; often restricted from giving unusual increases to on-board personnel, they also have salary ranges that have not kept pace with inflation--thus they cannot hire "Joe College" at a competitive initial salary either.

3) Other (hygienic) Job Conditions. Herzberg also describes other "demotivators" or hygiene factors which may cause someone dissatisfaction within a given environment. These include such things as interpersonal relations, status, company policy and administration, and working conditions. College and university environments frequently are very positive in most hygiene factors. A recent article in Infosystems on "Solving the DP Personnel Shortage" [6] was filled with examples of companies working on hygiene factors, among the most poignant a desire to establish a "home-town" atmosphere to attract and retain people.

4) Work Content. The best advice which any career-oriented person can receive is to seek a position which is rewarding in its work content. Numerous studies have shown the importance of interesting and fulfilling work to data processing personnel. In fact, an IDC survey [7] says that the largest cause of turnover among programmers is, simply enough, better jobs. It should be evident that no organization can offer optimum professional growth for everyone, and, hence, there will always be people seeking new employment in order to expand themselves technically or professionally.

5) Poor Management. Organizational mythology often blames the immediate supervisor for a turnover problem. "I wonder," people who have left a situation commiserate with each other, "when management will realize the source of the problem." Incompatibility with the supervisor will almost never be cited as a reason for leaving. In a Bureau of National Affairs Survey, "supervision" was only the fourth-most frequent reason for leaving (after personal problems, pay, and job opportunities) [8] . Nevertheless, poor supervision can be an important factor. As the old joke goes "I left for the sake of my health--I was sick of my boss!" What the "boss" needs to recognize is that some turnover is going to be the result of unavoidable personality differences. But some could also be the result of personal failure.

6) Work Force Changes. Some turnover, the IDC survey cited above notes, is due to the less compliant nature of the work force. People now will make job changes when their private lives are interfered with, when travel or

non-professional activities beckon, or even when they are tired of working. Some authorities talk about a "new breed" of worker, whose ties to his job or his profession are no longer enough to keep him in the same situation if anything else comes along.

7) Random Reasons. Although many of the foregoing reasons may actually be the impetus for leaving, exit interviews frequently turn up a host of random reasons, whose major common characteristic is that they do not blame the organization. To clarify as much as possible, there is ordinarily no supposition that these reasons, when given, are false ones. A move to another geographic location for family reasons, a career opportunity for a spouse causing a move, or an extended illness all are the kinds of random effects which can be hidden within the turnover statistics. So can be retirement, death, involuntary termination, or inter-departmental promotion.

Ideal Turnover

What is the ideal turnover situation? To ask that question is to imply that we do not want zero turnover; we don't want to retain all of our people forever. With all of the pressures noted above, is there a standard which accounts for avoidable and unavoidable turnover and does not lead to excess?

Although some people have said that a 6% turnover figure is "acceptable... and desirable," [9] most anecdotal figures are hair-curling: a recent Computerworld article [10] cites a 35% turnover in various technical occupations (including those computer-related) as reported in the American Electronic Association 1980 Compensation Survey. At a recent national professional society meeting, an installation with a 60% turnover rate was cited as "typical." [11] Another author in Computerworld says that "yearly DP turnover rates of 30% to 40% are not uncommon." [12]

Setting aside anecdotes, the figure most often cited as an acceptable standard is a traditional turnover rate of 20%. One piece of valid data is the National Salary Survey - Computer Programming, which showed a turnover rate of 21.8% in 1966 and 1968. [13] Although that study is relatively old, its conclusions seem empirically correct today, although various factors cause computer programmers to have a somewhat higher mobility rate than DP employees generally. The Datamation study of 289 installations in 1979 should also be noted. In that study a total DP staff turnover of 28% was found. Table 1 below breaks down that 28% into the different occupational categories within the computing services organization.

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Occupation Type	Annual Turnover Reported
Data Entry	30%
Production Control	20%
Operations	29%
Applications Programming	34%
Systems Programming	22%
Systems Analysis	20%
Data Base Administration	8%
Data Communications	21%
Others	18%
All occupations	28%

Table 1: 1979 *Datamation* Survey of Computing Services Turnover

Although the clear implication in the article is that the high turnover discovered in the survey was a result of temporary professional or national econonic conditions, most managers within the profession know that high turnover has been a long-term problem. If there are other short-term features pushing the rate higher, it should be remembered that the baseline rate (that rate which should be normal) is still 20%.

Aside from the fact that an expectable 20% turnover rate is still higher than what some people have termed "acceptable and desirable," what is the significance of that figure? In the college and university community, that figure is unusual. Furthermore, it is frequently not adequately communicated to responsible administrators. It may well be that the people who work within the computing services organization have particularly different management problems than most other college employees. For instance, at Miami-Dade Community College, the personnel turnover rate of all employees in 1979 was 16.4%; faculty only experienced a 7.5% turnover rate. Within the context of the other M-DCC areas, a standard turnover of 20% within Systems Analysis and Programming seems to point to a problem. So the first task is to assert that a normal turnover rate is nothing to be ashamed of. Normal turnover does imply some management activity which may not be obvious. Recruitment is going to be a constant function. Departmental operation should also be designed to cope with normal turnover; for instance, the importance of standardization cannot be stressed enough. It has never been the case that organizations could afford idiosyncratic programs or documentation, but we often forget that principle when beset by other pressures. Another example is that an active program of system cross-training ought to be routine. For that matter, normal turnover also means that training of all kinds ought to be important. And, finally, fear of turnover should not dissuade the manager from taking unpleasant disciplinary action when required.

Ironically, too low a turnover rate could also be bad. Organizations with a technical orientation need new ideas, new vigor, new ways of looking at old situations. John Diesem tells an odd story [14] of a consulting job he had in which he concluded that the installation was technically provincial because the staff had failed to upgrade its systems in several years. His summary to his client was that "you pay too well and your turnover is too low." It is remarkable the difference a few people can make who are not bound (by inertia or tiredness) to the same old way of doing things. New blood is needed because the organization that remains static in a field with as many technological changes as computing is actually going backwards.

Procedures to Reduce Turnover

Assuming the turnover rate in an organization is unhealthy, what can be done to drive it down?

Retention is a management problem. It is altogether a mistake for a responsible manager to believe himself to be buffeted about by forces outside his control. Too often, data processing managers (and not just those in colleges and universities) withdraw into a morose state when key people depart. One observer [15] assigns the major responsibility to the manager when he says that solutions to turnover "must be based on dealing with individual employees in a manner that shows the employees you are genuinely concerned about them, will help them to develop professionally, will reward them appropriately, and will help each one to make the best possible contribution...."

Without the pretense of holding it up as an ideal situation, let me illustrate by noting some of the procedures and activities we have taken at Miami-Dade Community College:

1) Communication is stressed. From the College President on down, written and oral communication is used to assure that the importance of College programs is clear to all personnel. Systems Analysis and Programming has a monthly divisional meeting and there are other frequent formal and informal meetings. A further benefit of communication is to help everyone feel that he is a part of the total enterprise.

2) Skill improvement is recognized. Systems Analysis and Programming is very proud of its competency-based job structure. [16,17] By use of this technique, people who achieve specific goals in their skill improvement program achieve specific recognition.

3) Job enrichment is attempted. There is a conscious attempt to concentrate on job values, to emphasize the rewards available to an individual in the work itself. One goal of this kind of program is to condition people to being self-motivated, or at least to achieve gratification with the knowledge that a job was well done and that the next job will pose even more of a challenge as a consequence. In specific terms, although we value detailed system knowledge, we value flexibility even more and we employ it by switching people's assignments.

4) Working conditions are pleasant. Since moving into our new building in August 1978, we have continuously sought to protect and improve the physical surroundings. We have experimented with flexible working hours and with a four-day week. Increasing use of tools of the trade (ranging from automated documentation to individual terminals to facilitative software) improve working conditions constantly. Suggestions are frequently solicited, received, and acted upon.

5) Money adjustments are made. Despite the generally-poor financial environment within colleges, M-DCC has been able to keep its salaries close to competition. Studies of individual salaries show excellent growth patterns, produced by normal cost-of-living and longevity increments supplemented by competency-based upgrades and special increases. Salary surveys are constantly consulted in order to scale minimum and average salaries properly.

6) Work assignments are fair. I'm always very uncomfortable mentioning "fairness," because it seems like an undebatable and bland virtue. And yet, I'm convinced that organizational fairness is not that easily attained or recognized. By "fairness" in this context I mean that the needs of individual employees are recognized and that attempts are made to keep work pressures on an individual within his or her capabilities.

7) Individuals are recognized. M-DCC may be unique in the sense of appreciation which flows from everyone who is benefited by help. It is not unusual for Systems Analysis and Programming to receive three "thank-you" letters a month from different constituents within the College. Individuals who perform well are recognized internally when external acknowlegment may not occur.

Even with this kind of healthy environment, Miami-Dade's Computer Services area still experiences higher turnover than we in managment would like. We hope that our discontent leads to continuous improvements in our situation, though.

Conclusions

Whatever authority I may muster on the subject of personnel retention does not come entirely from experience. There are some general principles worth passing along which, rather than being subtle special conditions applicable only at Miami-Dade Community College, should be applicable to any administrator trying to deal with personnel retention in the information systems organization.

1) A good manager monitors and tries to affect "hygiene factors." Herzberg has described these hygiene factors as pay, the possibility for growth, interpersonal relations, status, technical supervision, policies and administration, working conditions, personal life, and job security. These provide the matrix in which the real work activities can take place. Although good "hygiene" cannot motivate, poor "hygiene" can de-motivate, leading to a higher incidence of people leaving for better situations. (This is the theme of the excellent presentation on retention given by Keith Gondron at last year's CAUSE Conference. [18])

2) A good manager provides meaningful work as a motivator. It is easy for an employee to be cynical about "challenge" when the challenge is hollow. More and better responsibility will hold people, especially those you want to hold. You don't want those who cannot respond to a real challenge.

3) A good manager analyzes reasons for abnormal turnover and proposes solutions, energetically and with perseverance. Furthermore, the manager must undertake all of those activities which can help the organization

survive normal turnover.

4) A good manager emphasizes the positive features of the present environment. Too often managers succumb to discouragement that they propagate at their own peril. Blind optimism is not needed, but it is certainly less harmful than gloomy pessimism.

5) A good manager recognizes and competes with the competition for organizational talent. Moping about how "industry pays more" is not going to solve anything. Technically-competent personnel can find significant advantages to employment at colleges and universities now and in the future. For that matter, the good manager also recognizes that personnel departure can be positive, in that it provides another opportunity to recruit personnel with needed aptitudes.

Undeniably, the college and university environment does offer a special challenge to retain just those people who can provide the necessary element of excellence to its administrative and academic computing. Both the projected national computer personnel shortage and the increasing difficulty in obtaining funds mitigate against any lessening of personnel pressures. Even so, the manager of the information systems resource must not forego opportunities to control turnover by all available means. Uncontrolled turnover can lead to the kind of organizational chaos which will prevent the information systems function from having its rightful influence on higher education.

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References

[1] Paul Pigors, Charles A. Myers, Personnel Administration, McGraw-Hill, Inc., 1965, p. 301.

[2] Randall B. Dunham, Frank J. Smith, Organizational Surveys, Scott, Foreman & Co., 1979, p. 45.

[3] "DPers Highly Mobile," Computerworld, Nov. 19, 1979, p. 10.

[4] Frederick Herzberg et al., The Motivation to Work, John Wiley & Sons, Inc., 1959.

[5] R. A. McLaughlin, "That Old Bugaboo, Turnover," Datamation, October, 1979, pp. 97-101.

[6] Frederick W. Miller (editor), "Solving the DP Shortage," Infosystems, July, 1980, pp. 40-44.

[7] Harold S. Bolt, "In Depth," Computerworld, Sept. 15, 1980, p. ID/6.

[8] Hubert J. Chruden, Arthur W. Sherman, Personnel Management, South-Western Publishing Co., 1972, p. 646.

[9] Carol Norvich, private correspondence, August 5, 1980.

[10] "Executives Pay Leaps by 9%," Computerworld, Aug. 11, 1980, p. 61.

[11] Robert B. Forest, "The Rocky MIS Horror Show," Infosystems, November, 1980, p. 91.

[12] Robert C. Schlegel, "Management Needs Long-Term Personnel Plan," Computerworld, June 2, 1980, p. 31.

[13] Jay R. Schuster & Barbara Clark, "How Employees Measure Their Pay," compiled in Selected Articles from Compensation Review, AMACOM, 1974, p. 70.

[14] John Diesem, "Inversion Version," Datamation, October, 1979, p. 101.

[15] Gary Dusick, letter to the editor, Datamation, February, 1980, p. 35.

[16] Competency-Based Job Descriptions for Applications Programmers: A Case History, Proceedings at the 25th Annual College and University Machine Records Conference (Salt Lake City, Utah, 1980).

[17] Competency-Based Job Descriptions for Programmers, Proceedings of the 1978 CAUSE National Conference (New Orleans, LA., 1978).

[18] Employee Retention in the 1980's, Proceedings of the 1979 CAUSE National Conference (Orlando, Florida, 1979).

LEGAL PROTECTION FOR COMPUTER PROGRAMS

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The presentation by Ms. Gasaway and Ms. Murphy was based on a series of five articles which appeared in CAUSE/EFFECT, the CAUSE magazine. The series covered such topics as copyright protection, patent protection, trade secret protection and unfair competition. Demand for the articles prompted CAUSE to publish them as a monograph entitled Legal Protection for Computer Programs. The monograph is available from the CAUSE National Office.

"IT ALWAYS HAPPENS TO THE OTHER GUY"

by

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This paper is an account of events following a major fire in the Sandford Fleming Building, University of Toronto, February 11, 1977, and the subsequent restoration of computer service.

INTRODUCTION

On February 11, 1977 a multi-million dollar fire ravaged the Sandford Fleming Building - a 70-year old historical structure located on the St. George Campus of the University of Toronto. At the conclusion of the fire, all tenants of the building had suffered losses ranging from destruction of office and interruption of services to complete loss of all equipment, space and records. The University of Toronto Computer Centre (UTCC) was one of the tenants of this building.

This paper is a case study of:

- the short term effects that this blaze had on the operation and services of UTCC
- the efforts expended by UTCC, the University of Toronto and the vendors to set up an interim service and then resurrect the machine room facilities in the Sandford Fleming Building
- the ramifications to UTCC'S long term objectives, plans and services and how UTCC is continuing the recovery and re-equipment process since the fire
- the experiences of UTCC as they relate to the formulation of a contingency plan or the invocation of such a plan

The short term recovery process will be dealt with in a fairly detailed level in order to give the audience an insight into the substantial effort required to effect the interim service and short term recovery of the facilities as well as the human aspect of such a concentrated effort under unfavourable working conditions.

The discussion of points learned from the UTCC experience is a somewhat loose collection of hints and comments. Many of these points are included because they were of significance to UTCC, even though the may not be relevant to other enterprises or institutions. The discussion proceeds from the viewpoint of an observer since many people believe that "It always happens to the other guy" - except that in the case of UTCC, it happened to us.

SECTION I

UTCC - Organization, Physical Layout, Sandford Fleming Building

The University of Toronto Computer Centre is a service department organized to provide time-sharing and batch services to the University community. UTCC'S customers use the facilities for education, research and administration. Major types of services include:

- general purpose (batch, TSO)
- administrative (batch, TP)
- student batch (High Speed Job Stream)
- general purpose time-sharing (APL, ATS)
- Computer Research Facility (mini-computer real time and special services)

At the time of the fire, UTCC operated 3 IBM mainframes and operated the Computer Research Facility in 4 different locations on the St. George Campus of U of T located in downtown Toronto. An IBM S/370-165II was located on the first floor of the Sandford Fleming Building, the CRF facility was located directly above the 165 on the second floor of same building. Two other machines, a S/370-155II and a S/360-65, were located in two other buildings nearby. The S/370-165II offered General Purpose Job Stream, student batch (HSJS) APL/SV and TSO services to the community through a walk-in facility, 16 batch remote and 55 interactive TP lines. The S/370-155II provided IMS/TP/BATCH services with 1 batch remote and 20 TP lines supporting 80 devices. The S/360-65 provided APL and ATS services over approximately 100 interactive TP lines. The Computer Research Facility housed a DEC GT44 and DEC GT40 with several unique and specialized devices attached to them. A substantial portion of the batch and interactive TP lines for all these sites was supplied by UTCC in University steam tunnels which ran throughout the majority of campus.

The Sandford Fleming Building was a U-shaped structure attached to another more modern building thus forming a double square. Two-thirds of the Sandford Fleming Building were 70 years old. The frame of the building was block and steel girder construction with a concrete centre hall and brick supporting walls. The offices had mill flooring throughout. There were three occupied floors plus a full basement as well as an unoccupied fourth storey which was essentially an attic. The roof had a wooden base, covered with tar sealants and gravel. No fire separations existed in the elevators, duct shafts, conduit raceways or stairwells. Fire detector and suppressant systems were manual - a network of pull stations and a coiled-hose reel system.

The newer section of the building (named the Burton Wing) housed the UTCC machine facilities and was built with a concrete frame and concrete floor. Ionization detectors were installed in the machine rooms; the balance of the Burton wing had manual fire pull stations. Fire suppressant equipment ranged from extinguishers in and near the machine room areas to manually activated water-hose systems. The Burton wing used four full floors actively. Stairwells were located at the junctions with the adjoining Galbraith Building.

SECTION 2

FIRE

The fire in the Sandford Fleming Building was detected at approximately 1:30 a.m. on February 11, 1977 by a student who noticed the smoke and turned in the alarm. The fire seemed to have its beginning in or under a two-storey lecture theatre in the north east corner of the building. Although the cause was never exactly established, the most reasonable likelihood was that it was an electrical fire.

The fire rapidly spread up through the lecture theatre and into the the wooden attic. From there it went in two directions along the North and East wings. Within a short time the roof collapsed into both the North and East attics which in turn collapsed onto the third floor. Both the lecture theatre where the fire began and another larger theatre collapsed completely spreading the fire down to the first floor in some sections and allowing some penthouse equipment to fall through shafts to the basement .

The fire burned throughout the night until it was brought under control at 8:00 a.m. It was declared a three-alarm plus blaze and some twenty or more pieces of equipment from the Toronto Fire Department were at the scene. Eight Toronto fireman were injured during the operation, fortunately none seriously. No University of Toronto staff or students were injured.

By the conclusion of the fire, the following damage and destruction were evident:

- Both major lecture theatres, the third floor, attic and roof of the North and East wings were totally destroyed.

- Severe water damage was incurred on other floors in the North and East wings .

- Heavy water damage occurred in the adjoining Galbraith Building on all floors plus moderate damage in the South wing of the Sandford Fleming Building.

- All Building services were knocked out either by the collapsing interior or by the water which entered the steam tunnel system.

- Building services and some water damage occurred in many surrounding buildings since the steam tunnels served as perfect underground channels and dumped water into practically all basements in the area.

The next few paragraphs describe the actions of UTCC personnel during the period when the fire was out of control. Two operators were on duty at the time the alarm was turned in. The bell rang only for a few seconds and was in general ignored as the duration period was similar to that for alarm tests which are frequently carried out. The first notificaton UTCC personnel received occurred when a fireman entered the computer room and told the console operator to leave. After notifying her supervisor and powering down the system, she left the building and called a further damage report to her supervisor. Phone calls were then placed to various members of UTCC management who uniformly were not awakened by the telephone calls. Finally the Acting Director was contacted who proceeded to the scene of the fire. UTCC personnel were allowed back into the building in order to remove what they could since the fire was still at the other end of the building. In succession, all on-line DASD, off-line DASD and finally the entire tape library of approximately 4000 volumes, were carried out and deposited in a cafeteria across the laneway. The evacuation crew by this time had grown to several staff members, campus police and some passerbys. Coat trees were fashioned into carrying sticks by breaking off the hooks; this allowed the removal of several dozen tapes at one time. Later, some miscellaneous listings and files were evacuated as well as some materials and tapes from the Computer Research Facility on the second floor.

During this period, the fire department continued the battle with the fire. While the evacuation of the library media was underway, the fire department spread tarpaulins over all the computer equipment and then in the offices as they were reached. At approximately 0700 hours, the building was sealed due to the danger of the gases emanating from the fire, the possibility of structural collapse from the water and fire, and the rapidly growing crowd.

About the same time, UTCC opened up a "War Room" in 49 St. George St., a house close to the fire occupied by UTCC.

SECTION 3

Recovery and Restoration of UTCC Services

The recovery process is described in two parts - short range and interim range. The long range recovery is still in progress and is described in the next section - Present Status and Future

Short Range

Friday, February 11

Management assembled in the war room by 0730. Initially, plans were laid to obtain a damage assessment, prepare a press release and user notification, obtain an inventory of salvaged media and draft a staff schedule.

Orders were given to the effect that all supervisors and managers, secretaries and the publications group were to remain at work while all other staff were released to go home. (Nobody went home, they went back to watch the fire.) A rough plan for answering phone and relaying messages was set up. Management then began discussing what alternate arrangements could be made for our services either on our other two machines or elsewhere. Since the fire had been given wide coverage by the media, other computer centres began to call with offers of assistance which were accepted for consideration. A user notification was prepared by hand on large paper and posted at all sites informing our users that services were out for the weekend and to watch for further announcements on Monday.

Among the offers received was one from IBM Canada Limited which would allow the operation of our MVT system under VM supporting remote batch terminals if the machine could be made available. IBM'S offer was made as a tentative offer only; UTCC accepted in principle: Assessment turned to Bell lines and what sites could be used as terminals if phone lines could be arranged.

By afternoon, UTCC personnel were allowed a brief inspection of the facilities. A cursory look showed us that the machine room was in surprisingly good shape. However, all offices and user areas had sustained severe water damage and were for the most part a hopeless mess. Some more materials were removed, including all the empty tape cabinets. Following this, the tape library was moved to another building for proper examination and cleaning.

At 2 p.m. UTCC realized that there was no heat in the building and that there was a very real possibility of freezing in the coolant distribution unit of the 165 if it was not drained. After some negotiations, UTCC was again allowed to enter the site with IBM personnel to drain the machine coolant and remove some other materials. Two IBM 3780's arrived at a terminal site and setup was begun although it wasn't known whether they would be of use at this point.

By this time, most personnel left for a much needed rest and activities of the first day drew to a close.

Saturday, February 12

At 9 a.m. on Saturday, a planning meeting was held, attended by UTCC management and IBM representatives. At this time, IBM confirmed the availability of a S/370-168 at IBM Canada Limited's Large System Support Centre located at the Valleybrook Computing Centre in Toronto. A short range plan was developed as follows:

- run UTCC's MVT under VM
- provide batch and high-speed service only on a Monday-Friday single shift basis
- run with seven batch remotes, including the two 3780's supplied by IBM plus five of UTCC's remotes on seven TP lines
- Convert UTCC's DASD to fit IBM's 3330-11 complement
- move the entire tape library to the IBM site
- Be on the air at 10:00 a.m. Monday

The day's projects were quickly roughed out into four essential parts:

- plan out the telecommunication links
- begin conversion of several online 2314's to 3330's

- Commence software installation under VM

- on IBM's part, locate more DASD and a 3705 and get it installed.

By the afternoon, these efforts were well underway, including the hardware installations and by later afternoon, the first IPL of the system was attempted. Software efforts continued primarily in the area of catalog rebuilding and ZAP's to UCB's, accounting routines and other areas of our system. By 2400 hours we had reached the point where a workable system would IPL and run jobs, but no on-line files existed, nor any 3705 system generation.

Sunday, February 13

Again, a management meeting convened in the "war-room" to assess the progress of the previous day and plan out the balance of Sunday's activities. This morning's start-off meeting became the working communication for the balance of the short range recovery. Throughout the day work continued at the IBM data centre on the system software. Bell Canada installed 7 TP lines on a dial-up basis since 4800 baud modems had still not been located. The system was this time functional although there was still a DASD shortage and the TP gen project was furiously shooting bugs.

Back at the St. George Campus, a staffing plan for the first week was finalized and user notifications and rough documentation was prepared. In addition, the tape library had been examined, sorted, set up and inventoried prior to packing for the move to the IBM data centre which was planned for the Monday morning.

At 6 p.m., testing was begun from a remote site and at 8 p.m. on Sunday, the first successful production of a test job was achieved. Since the short range objectives had been met, the green light for Monday service was given.

Monday, February 14

Service came up at 10 a.m. Tapes were brought on site as well as another string of 3330's which IBM had located. Minor work continued on the system as problems were reported, but essentially production was as stable as could be expected under the circumstances. On the St. George Campus, a battery of meetings concerning relocation space and insurance matters were held with the University Administration. UTCC personnel were given a full site inspection with the Physical Plant Department which confirmed that the machine room areas were in good shape, the user public terminal areas were a complete wipeout, and all utilities were out of service. However, by the end of the day, it began to look faintly possible that the machine room could be resurrected.

Tuesday, February 15

Service continued at the IBM Data Centre without any major problems. At UTCC, all vendors were brought in for a full inspection tour to assess what remedial work would be necessary to re-activate their equipment. Bell Canada began the task of repairing the equipment in their telephone room which had taken heavy water damage as well as a direct hit from a piece of debris from the roof. Drying operations were started in the motor generator and power transformer rooms.

Wednesday, February 16

Power was restored to the Sandford Fleming Building. Once power became available, it became possible to commence the clean-up of the machine room and CRF on the second floor which up until this point had remained essentially dormant. All IBM equipment in the older part of the building was retrieved and moved to storage. Air conditioning service was restored and tested. Bell circuits for TP services were checked out; Personnel barriers were installed, allowing the University to open the south wing of the building safely. In CRF, all equipment checked out and as a result service could be restored.

Thursday, February 17

Restoration work on the building services and equipment repair continued. During the day, coolant water was re-installed in the S370-165, the motor generators were tested under load and a test IPL was attempted. The system came up perfectly and all initial diagnostics worked properly. Based on this, the decision was taken to move back Saturday. At the IBM Data Centre, the temporary service continued to run well and by this time 4800 baud TP service on dedicated lines had been installed. Thursday's production approached the normal figures for the equivalent shift on the S370-165 before the fire.

Friday, February 18

The S/370-165 was used to run student batch work from one site during the day. This was done as an alternative to running 24 hours of diagnostics which the vendors had requested. An intermediate plan was laid to move all systems back to UTCC after production on Friday, restore service on Saturday and reach full service by the end of shift on Saturday with the return of the tape library.

Saturday/Sunday - February 18/19

On Saturday, service came up on schedule, without tape services. By 1600 hours the tape library had been moved back and was properly set up. Sunday ran as a normal production weekend day without a single problem. This marked the successful completion of UTCC'S short range plan 9 days after the fire.

Interim Range Plan

The short range plan described above was primarily designed to provide an alternate service available to our users as quickly as possible. A decision had been made to ignore any longer term alternative planning for at least a few days until the temporary service was up and in production. IBM'S offer carried an availability commitment for two weeks with a review planned for one week after the fire.

However, the possibility of returning to our site using temporary services became apparent by the Tuesday following the fire, so the interim planning effort quickly evolved to relocation and re-establishment of our non-machine-room functions, that is relocation of our personnel and re-establishment of our user access location.

The week following our return to the Sandford Fleming Building thus began with three parallel efforts:

- refurbish all repairable equipment that had been in the public areas
- locate space for a new student terminal and set it up
- rehouse all UTCC staff who had lost office space

Work on point one went quite well. As equipment was repaired from the one lost terminal site, it was shoehorned into the other site until the available space was absolutely jammed. The allocation of space for a new student terminal occurred fairly soon thereafter. The space size and quality was acceptable; however, the location was somewhat further away than we wished , and a technical bypass had to be designed and some equipment- a pair of 2944 channel extenders- was located through a used equipment broker. Space was allocated in three other locations for our staff.

By this time, our interim plan was firm and straight forward:

- rehouse all our personnel

- relocate EUT (the student terminal)
- conclude this by the end of the week.

Many problems arose during the week, making our time objective nearly impossible to meet. A full inventory and salvage project had to be undertaken in the fire zone. Working conditions in this area were extreme with sub-freezing temperatures, no light or electricity and debris, and embers and water everywhere to a depth of several inches or more. Many adhoc decisions had to be made as to what should be saved versus what should be scrapped. Nevertheless, by the end of week, the furniture and materials still usable were ready to be moved to the new sites. Unfortunately, the new sites were far from ready. It was proving difficult to get the incumbents from the new locations moved out. Some of the sites had few electrical outlets and few spare telephone lines. Moreover, it was extremely difficult to make arrangements with a mover. However, during the following week, staff were moved to their new locations so, by the end of the week, everyone had a place to sit, although only a few phones had been obtained due to the shortage of circuits.

Work had been progressing in the new student terminal, but efforts to get the 2944 channel extenders delivered were not very successful.

Over subsequent weeks, the 2944's were repeatedly delayed for a variety of reasons. Ultimately, they arrived in mid March. The terminal was then installed rapidly and tested. To our horror, we were immediately hit with continual channel overruns; the 2944's wouldn't do the job as originally planned.

Within a short period two fall back plans were developed - neither of which were palatable. However, one of the two plans, which involved the laying of cables through steam tunnels which were beyond IBM specification lengths was tested successfully and installed. Everything was now completed except for the installation of the balance of the telephone circuits. After much delay this was finally completed on May 9, marking the end of the interim range plan.

SECTION 4

Present Status and Future

(Long Range Plan - In Progress)

By mid-May, staff functions had returned to a reasonable degree of normality. Plans had been made to move our major user access area out of the Sandford Fleming Building into the Engineering Annex ground floor and to renovate and expand some of the temporary office space on the second floor to ease the crowded conditions.

However, before the fire, three major projects had been in progress. The first project involved the sale of the S/370-155II , the purchase of a second S/370-165II and the installation of this machine in the Sandford Fleming Building machine room. Second, UTCC was working on the development of MVS for installation on the academic 165 over the summer and on the proposed administrative 165 by December 1977. A third project had been approved to purchase another computer for time-sharing purposes and install it also in the Sandford Fleming Building.

Plan 1 had to be abandoned because of the fire. The Sandford Fleming Building was no longer viable as a mainframe site until it was rebuilt. Since the 155 did not have the capacity to make it through the next academic registration, a S/370-158 was rented as an interim replacement.

The development of MVS was resumed after a long delay brought on by the recovery operation. The academic MVS finally entered user test in the fall of 1977. After several weeks of testing, UTCC reached the conclusion that the 165 did not have the capacity to run production with the existing software services and without the ability to balance loads in a centralized environment, therefore MVS implementation had to be shelved. The administrative MVS development was successful and was installed on March 1978.

Plan 3 suffered a long delay but by May 1977 the vendor responses to the RFI were reviewed and a selection made in June 1977. The new machine - a DEC 1060 - arrived very quickly and had to be stored on site. This machine was destined to be installed in space made available by the move of the user access area. This move was delayed several months because of an electricians strike in Toronto. However, the machine was finally installed and brought up in December 1977.

Throughout this period, discussions were being conducted on two major issues for the University - both of which had a direct bearing on UTCC'S future. The first issue concerned the proposition of merging UTCC with York-Ryerson Computer Centre - a computer service which supplied the two other institutions in Toronto - York University and Ryerson Polytechnical Institute. A task force had been working prior to and after the fire and tabled its report in May 1977. Included in this was a recommendation to centralize off campus. Initially, the second issue was very straight forward "what to do about the burned-out Fleming Building". As can be expected, these issues quickly became enmeshed, since UTCC would have to move out for the renovations and had nowhere to go. Also, UTCC was not popular as a building tenant, and, once the opportunity arose to get us out, we were not included in any plans to move back after the renovation.

The task force report, which supported the feasibility of a combined site with the other two institutions, elicited much discussion at U of T both for and against the merger. In the end, based on the user community response, the recommendation was not acted upon. This meant that permanent space had to be found for a new site Such space was ultimately allocated adjacent to the S/360-65 machine room and, commencing July 1978, a project to expand and renovate the machine room and upgrade the utility services was undertaken. The new 8000 square-foot machine room, which can support up to 3 water-cooled CPU's was completed by mid-November 1978. A further 8000 square feet of office space and supplies storage were renovated simultaneously on the same floor.

Concurrent with this renovation, approval was given to re-equip and upgrade UTCC's computer equipment. A large project to consolidate all IBM equipment in the new site was developed. A hectic period from mid-November to mid-March 1979 ensued; during this period a 3033 and 3031 were installed in the new site, the S/370-165II and peripherals were dismantled and moved to the new site and re-installed, the S/360-65 and S/370-158 were removed from service, all peripherals were moved from the 158 to the 3031, all DASD was upgraded to 3330-11 emulation on non-removable media, MVS was installed on the 3033 and MVT was upgraded on the 165. On Sunday, March 11, 1979, exactly 25 months after the fire the final configurations and software were complete in the new site, and full production with all machines commenced at 00:00 hours on Monday, March 12, thus bringing the recovery and re-equipment project for the IBM based services to a close.

The above describes the present status of UTCC as far as long-range recovery is concerned as of December 1980. Much work still remains to be done in the area of our DEC-based services before the ripple effect of the fire finally dies out. During the consolidation of the IBM-based services, all DEC facilities were moved into the space vacated by the S/370-165II in the Sandford Fleming building to free up other floor space in order for a phased renovation to be carried out on the structure. Furthermore, the complement of DEC equipment was substantially expanded by upgrading the DEC 1060 to a DEC 1090 and adding a DEC 11/70 which has resulted in substantial overcrowding in the site and reliance on over-burdened utilities that are affected by the renovation project. The project has now reached the stage where UTCC must once again move equipment and personnel to allow the next phase of Sandford Fleming Building renovation to take place. At present, renovation and re-arrangment of the McLennan Building site to accomodate the large DEC equipment and personnel is nearing completion. In late December, the DEC1090 and 11/70 will be moved to this site. However, the DEC mini-computer equipment will be moved at the same time to another temporary site before moving to its permanent location. It will be well in 1981 before UTCC can finally say that we have settled down permanently and the story of our recovery can finally be declared closed.

SECTION 5

Disaster Planning, Prevention and Recovery

This final section documents some points from the UTCC experience concerning disaster planning and recovery. These points are in all likelihood well known to enterprises that have developed a disaster plan or have been through a recovery from a contingency situation. The purpose here is simply to highlight some miscellaneous aspects of our experience that were perhaps unexpected or important to us in our efforts to effect the restoration of our service.

The most important point to be recognized is that it is impossible to advise others of specifics or techniques of recovery from a disaster. The specific experiences at UTCC would only be of use in the case of another fire occurring at the Sandford Fleming Building.

Of course, some experiences have a large bearing in our disaster planning efforts in future. However, it is quite clear that no two disasters will be alike and that disaster plans should be designed from the outset to be flexible enough to cover the widest range of situations.

Disaster planning is a function of the attitude of the enterprise. The key ingredients that will drive or limit any planning or maintenance are:

- the senior corporate commitment
- the funds and staff available
- the criticality of the DP function to the enterprise

Clearly, without support, commitment and funds, no plan can be created or maintained successfully. Moreover, the data centre personnel are the most important asset to this. Without the magnificent effort put forth by each and every one of UTCC'S staff, we wouldn't have recovered so effectively.

It is important to keep a plan up-to-date and viable. Based on discussions UTCC has had with other groups following our experience, it is evident that a significant amount of literature exists on this subject in trade journals, standards, manuals, etc. One of the best exercises that you can devise for your disaster plan is to keep up-to-date on other experiences and measure your plan against these to see if it would do the job.

Two further miscellaneous points deserve mention before specifics are tabled below. One of the constant problems that UTCC had to work around during the recovery was the unavailability of our normal files and records - not machine records, but just ordinary day-to-day business records. From this we learned that it would be wise to consider keeping a set of critical files, personnel information and accounts information at a backup site as well as the normal machine-readable backups. Second if you occupy a multi-tenant facility, cross check your plans with other tenants. Data processing is not the only endeavour that needs good backup planning. Ensure that your plan fits your institution's or enterprise's overall backup plans and allows for co-ordination of recovery operations with other departments if required.

In relation to the instance of fire, the following points deserve consideration in the light of our experience. First, consult with your fire department or get expert opinions before you make major expenditures on fire detection/suppressant equipment. Satisfying insurance regulations and building codes is important, but this does not constitute entire or adequate protection. Moreover, you may be surprised to find out what your fire department can do during a fire (in the case of tarpaulins UTCC was supplied by the Toronto Fire Department).

Allow the fire department to fight fires. If your personnel have any time to spare, direct this time towards rescuing your critical packs and tapes rather than battling fires which your personnel are not trained to combat.

Put away materials at night. UTCC lost a lot of "small stuff" typewriters, calculators, terminals and records simply because desks weren't cleaned up with care. In, several cases, typewriters were destroyed by water- damage while the manufacturer-supplied plastic cover remained nicely dry in the bottom drawer of a desk.

Nobody has any conception of the meaning of the terms "smoke and water damage" until one actually sees the effects. In all likelihood, this is where the damage will be done - plan your protection and suppressant systems accordingly. Based on what we observed, there is little protection against smoke and water damage once a fire gets out-of-control; the best attack against these lies clearly in the areas of fire detection and prevention in the first place.

Some general comments can be made about systems design. It should be a policy to design all systems, be they hardware, SCP, or applications based, with the thought of backup or portability in mind. In mutual sharing arrangements, efforts to match operating systems as much as possible are mandatory. For users of IBM mainframes, the VM operating system, because of its versatility and flexibility, might be very useful in a temporary site. In UTCC'S case, because we had saved our software, we were able to put our own system up on a foreign configuration quickly because of VM. It is also important to consider the ramifications of antique, unique or ultra-new hardware and the accompanying system generations. You will not likely be able to replace these items quickly and furthermore they can hamper your recovery or temporary backup site operation by their absence or by any previous modifications to your operating systems to support them.

Should you experience a disaster, some points from UTCC's experience are appropriate, particularly in those cases where partial damage was done. Should this be the situation, there will be an extra overhead to maintain the site during the outage. Remember that the site will have to be monitored for possible deterioration after the initial problem. Deterioration from weather, vandalism, or long-term effects from water etc. could be very real. Consider the types of supplies necessary to restore a site and where these are liable to be obtained. Consider how equipment could be salvaged even if the structure was damaged. Plan how your communications systems would work in such a situation, since you will be making do with whatever systems you can potentially devise and mis-communication is frequently the cause of errors and delays even during normal operations. Finally, should you be in the position of soliciting or receiving offers of assistance, keep careful records. We found that we went back to some of our offers even days later. Should you find yourself in the position of having to install an interim machine in another location we were somewhat surprised by the in-depth knowledge of available space volunteered by real-estate agents as far as alternate site arrangements were concerned.

The concluding paragraphs of this paper return to the theme expressed by the title "It always happens to the other guy". Many data centres view this as fact; our experience shows that it isn't always true. UTCC suggests that your disaster planning efforts should include the ability and willingness to help out someone else in such a situation; if not, then you cannot expect help in return. We endorse this attitude because our recovery was aided so much by the generosity of our friends in the data-processing industry. Without that help, our recovery would have been much more arduous and the impact of the outage much more severe to our users. The following points concern offers we received and potential areas of help we were not offered, but could have used.

As can be expected, we received offers primarily for raw machine time or batch production under an existing operating environment. In addition offers were made for floor space, media conversion, storage facilities and personnel help. We accepted gratefully some of these offers; we couldn't use others for a variety of reasons, but most frequently because of TP limitations.

We also learned by watching IBM Canada's efforts in converting a part of their data centre to support us that perhaps several things can be done to help someone else that one wouldn't normally think of. Consider your own ordering and procurement bottlenecks. The times that you have the most difficulty in obtaining or experiencing the longest delivery times are in general going to be the major stumbling blocks for someone trying to recover or establish a new temporary facility from scratch over the period of a few days.

In the area of machine support, your vendor would probably co-operate in quickly adding equipment to your complex to support someone else should the floor space be available. This is particularly important in the area of TP support where communications equipment could be quickly upgraded. Alternately, your vendor would likely respond to your request to remove devices from your site to help set up an interim configuration for someone else. Consider also any spare inventory of cables, modems, terminals, print-trains you might have. These might be tougher to locate than another mainframe. Ancillary devices e.g. bursting, binding, cheque imprinting or unit record are also not simple to replace, so access to your facilities could be very welcome.

Outside the machine room environment, there are many other areas where your help could be greatly appreciated. General space for offices or warehousing was one of our major shortages. Personnel-particularly for general duties-can be very helpful; for example, tape librarians, operators, secretarial help etc. Consider offering a truck with or without drivers. Not to be overlooked are DP furnishings, office furnishings, supplies - both office and computer, documentation, software manuals, microfiche. General office services, such as copiers, distribution facilities, printing, sign-making, even telephone services can be used. It is worth considering these points simply because if it was your data processing area that was out, you could very well need some or all of these materials and services.

In conclusion, UTCC hopes that, by hearing of our experiences, you will at least have an idea of the magnitude and scope of a recovery from a disaster. We hope you will be encouraged to review and update your management plans for any potential contingency.

UTCC was astounded and immeasurably gratified by the expressions of concern and offers of help we received. We chose the solutions that we felt were best for us at the time, but all offers of help were appreciated and considered. To all our friends in the data processing community who came forward so willingly with offers of assistance - Thank you! Hopefully, it will never happen to you, but if you should ever find yourself in a contingency situation, please call on us ... The other guys at UTCC.

CONTINGENCY PLANNING
FOR
CATASTROPHIC EVENTS IN DATA PROCESSING CENTERS

by

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CONTINGENCY PLANNING
FOR
CATASTROPHIC EVENTS IN DATA PROCESSING CENTERS

Most data processing executives understand that the capability of their DP centers is a critical resource of their organizations. They also realize that this concentration of resource is sensitive to natural disasters and even to malicious attack.

Still surveys show that fewer than one center in four has a current tested contingency plan. In other words, their strategy for dealing with a catastrophic event is total risk acceptance.

This results in part from the perception that little else can be done, in part from the search for and absence of global or miraculous solutions, in part from a reluctance to discuss the problem with managers and users, and in part from a lack of understanding of how to arrive at an effective plan.

In an attempt to alleviate these problems, this document will discuss the need for such a plan, cost effective strategies for dealing with disasters and the planning process. While the need for operational contingency plans is recognized, discussion here will be limited to events so severe as to deny use of the dp center for more than twenty-four (24) hours.

While an understanding of the planning process must precede any planning activity, strategies will be treated first. Not only are they more fun, but until management believes that they exist, little time will be devoted to learning how to identify them.

The contingency plans discussed here are those designed to deal with events characterized by low rates of occurence, high levels of uncertainty and devastating consequences. Most managers will not see a disaster in their careers. For example, in the data processing industry, catastrophes are numbered in the high tens or low hundreds since the birth of the industry. When these are compared to the hundreds of thousands of installation years, it becomes obvious that a given installation can expect to see a catastrophe or disaster something less than once every one thousand years. Most businesses that have encountered such events have recovered; few have had more than a rudimentary plan.

On the other hand, the data processing operation may be so integral to the operation of the business, that the business could not survive long without it. A little foresight can significantly reduce the susceptibility of the installation to damage, improve the ability of the business to survive outages, reduce the duration of the outage and the cost of recovery.

It follows that a prudent manager should invest that little foresight in the contingency planning effort.

Three kinds of strategies will be discussed. Emergency strategies attempt to contain the damage caused by the disaster, so as to preserve the mission capability of the center. However, if the disaster is of such scope that the damage is extensive, backup and recovery plans will be needed. The backup plan provides for accomplishing critical portions of the mission between the disaster and the accomplishment of the recovery. The recovery plan provides for the permanent restoration of the mission capability.

Emergency Plan

Scope

The emergency plan should address all natural disasters and such manmade malicious events as riot, armed attack or war. These emergencies are characterized by low rates of occurence and high levels of uncertainty. It need not address items with measurable rates of occurence, such as operational errors or component failures. These should be addressed in operational procedures.

Strategies

Effective strategies for coping with emergencies involve early detection and planned containment. Such warning as is available for natural disasters will come via the media and or local authorities. Responsibility for monitoring the media and maintaining liaison with local authorities is usually assigned to the plant protection department. Data processing management should establish such liaison to plant protection as is indicated.

Mechanisms, such as smoke detectors and "burglar" alarms, should also be in place to alert local management to emergencies, such as fire and intrusions.

The plant and facilities department will ususally be responsible for providing such alarms. Care should be given to installing heat and smoke detectors where the combustibles are, such places as forms storage and office space, rather than in those locations where the valuables are, such as the computer room.

Strategies for detecting intruders will include direct observation, observation by means of closed circuit TV (CCTV), motion detectors or detectors on doors or windows. Strategies for limiting damage by intruders will include compartmentation and secondary barriers which either increase the intruders work factor, contain him, limit his access to a small set of resources at a time, increase his chances of apprehension, or prevent his escape.

Most strategies for limiting damage in emergencies will fit under the headings of evacuation, shelter, containment and suppression. Evacuation will be useful for protecting people in the face of fire, bomb threats or armed attack. Shelter may be useful for protecting property in the face of most emergencies and will protect people from such things as storm or earthquake.

1. Evacuation

The emergency plan must identify the conditions for evacuation and fix responsibility for the decision to evacuate. These conditions will include the obvious ones, such as fire or bomb threat, and less obvious conditions, such as a power failure in a highrise or windowless building. It will state how employees are to be notified. Employees must be trained in evacuation procedures. This is usually done in conjunction with drills for testing the plan.

2. Shelter

Emergency plan provisions for shelter will depend in part upon the environment and in part upon physical security measures in place. For example, if there is any water running through the overhead or if the integrity of the ceiling is in doubt, then the emergency plan may provide for plastic sheeting to be used for protecting sensitive resources, such as the computer, from falling water. If the perimiter walls of the building contain a large amount of glass, then in the event of storm or earthquake, the emergency plan may provide for moving people to the center of the building to protect them from flying glass.

3. Containment

While we normally think of the building as fuel for or victim of the fire, it is also an important mechanism for containing damage. While often overlooked, fire walls are extremely effective in protecting property and data and for limiting the extent of fire damage. For example, fire walls that separate the computer from high fuel source areas, such as office space, media storage, or forms storage, may be effective in protecting the computers from heat, smoke, water and particulate matter. Fire walls may also be useful in containing a fire to a limited area where it can be effectively fought.

4. Suppression

The emergency plan should also provide for manual or automatic fire fighting. Coupled with early detection, a trained person with the proper hand-held fire extinguisher can be effective in limiting the spread of fire. Automatic flooding systems employing water, CO$_2$, or other chemical agents may also be effective. Their use is particularly indicated for areas that have high fuel loads and low occupancy such as forms or media storage areas. A planned but limited response, such as hand-held fire extinguishers, is indicated for areas, such as the computer room, that are attended around the clock.

Automatic response systems should be carefully engineered and applied with caution, since they usually include some hazard of their own. Water sprinkler systems applied to computer rooms may represent a risk to the continued operation of the system. A "dry pipe" system with charging controlled by electronic detectors may be indicated or recessed sprinkler heads of the automatic on-off type may be used. These should be individually controlled, so that only those close to the fire are triggered. CO_2 systems may be hazardous to personnel. Delayed discharge combined with audible alarms and provisions for manual intervention should be considered. Accidental discharge of HALON systems will result in the waste of this expensive agent. Again, delayed discharge with provisions for manual intervention may be useful. Care must also be taken to insure that the system is properly charged and that it is adjusted to changes in walls or room contents, so that the proper concentration will be maintained.

II.

Backup

The backup plan addresses how critical portions of the mission will be accomplished between the loss of a service or resource, such as the data processing installation, and its recovery or restoration.

Backup is normally the responsibility of the user of the service. Therefore, the data processing department may be responsible for backup of the power supply should the public utility fail, but the payroll department is responsible for meeting the payroll if the data processing system fails. The rationale for this assignment of responsibility includes the obvious fact that when a service fails, the primary responsibility of the provider must be its recovery; that is his primary responsibility to the user. When there is a power blackout, the consumer worries about how to get along without electricity while the public utility company worries about how to get power back.

Also included in this rationale is the somewhat less obvious fact that the user of the service has far more choice and flexibility than the provider. In general, the only workable strategy for the provider of the service that will serve all of his users is instant recovery. If he can achieve that, then by definition there has been no disaster.

On the other hand, each user may look to different resources for backup and each individual can have multiple choices. For example, User A can look to several other installations in the same community, User B to two or more data servicers, User C can use manual backup, and User D some combination of these. Of course, the service provider may be able to provide some limited assistance to the extent that it is agreed to in advance and to the extent that it does not interfere with his primary responsibility of recovery. Thus, in the case of the blackout, the public utility may attempt to assist one confined to a respirator with a portable generator. The data processing department may attempt to assist users with emergency data. However, the user is still responsible for both negotiating in advance and in the event that even the limited agreed-to service is not provided.

In addition to such an agreement, the individual confined to the respirator will also have storage batteries, manual backup and a agreement with a hospital with its own power supply.

A. Inform Users

The user should be informed of his responsibility for backup. DP management should be responsible for informing him. Often DP management is reluctant to do this for fear that it will reduce user confidence in his system. It is more likely that it will only serve to rationalize a fear that he already had.

The information given to the user should include the assumed frequency - e.g., once per thousand years - the assumed scope - e.g., total loss of single site, limited to the site - the assumed recovery time (e.g., 90% of services restored within XX days) and any residual services (e.g., data) which he can expect to be still available. This information will become part of the assumptions of the backup plan.

B. Backup Jobs & Capacity

The backup plan should be done application by application and job by job. This is implicit in the concept of user responsiblity. Attempting to identify backup strategies for entire system environments complicates an already difficult task. Likewise, emphasis should be placed upon identifying backup capacity rather than backup systems. The capacity should come from enough alternative sources so that no single source will be stressed to its limits of discretion and so that the risk that adequate capacity will not be available is reduced to an acceptable level.

C. Identify Critical Jobs

Implicit in this definition of backup is the requirement to identify in advance what is critical. One useful definition of "critical" for a business information system is that critical jobs are those which must run at a certain time (i.e., there is no discretion as to the time at which it must run). Normally, such jobs are related to the cash flow of the business - e.g., billing, cash application, payables, payroll or dividends; to the product flow - e.g., production work orders, shipping orders; or to a billable service - e.g., billable data service.

Such jobs normally represent a limited portion of the total workload. However, they vary with the calendar. Those jobs which are critical on the first day of a period are different from those which are critical on the last day.

D. Identify Discretionary Jobs

In some cases it may be almost as useful to know those jobs which are clearly discretionary as it is to know those which must run. This may be particularly important for surviving locations, so that they can shed load to make capacity available to backup others.

E. Identify Requirements

For each job it is necessary to know the environment required to support it. This environment probably includes hardware, operating system and communications, as well as data and people. It is necessary to know not only the minimum environment required to run the job, but also what the required capacity of that environment is.

It will usually be easier to move a job to a larger hardware environment than to a smaller, and to a similar operating system than to a different one, but all are possible. As a general rule, many small jobs will be more portable than a few large ones.

F. Backup Strategies

Backup strategies will normally involve job portability and the identification of multiple alternative sources of capacity for each job. Alternative sources for hardware will include manual procedures, other installations by mission, other installations by formal or informal agreement, and the use of data servicers. Strategies for the software environment will include a portable operating system and or the use of a compatible host operating system.

Backup for the communications portion of the environment will include networking, alternate leased terminations, dial for lease, voice for data, and messenger or courier for voice.

Backup for data will include natural and special copies and people backup will include vendor and contractors.

1. Provide Portability

Each job has an environment that supports it and which is required in order to use it. In the early days of computers this was often a system identical to the one in which it normally ran. This resulted from the fact that the way one exploited the hardware was to have every job use all of the capacity and features of the system.

In today's systems we exploit the hardware by running multiple jobs at the same time. This gives us the option to design jobs, so that they are portable across a large number of possible environments.

In the light of the backup requirements it seems prudent to design jobs to be portable. Portability can be enhanced by software that shields the application from the hardware. Such software includes operating systems, high level languages, database managers and access methods. Historically, applications have bypassed this software in an attempt to improve performance or exploit device characteristics. As hardware cost continues to drop, the loss of portability does not seem to be justified by the small decrease in hardware cost.

When the user becomes aware of his responsibility for backup, job portability can be expected to become part of the original application design requirements.

2. Manual Procedures

For some computer applications it will never be satisfactory to go back to manual procedures even for a short time. On the other hand there is a large population of jobs for which this may be the most cost effective solution, so it is important that it be considered. It is often unattractive to DP people since it implies that the user can get along without them. On the other hand it may be attractive to the user simply because it is within his own control.

In some cases it may be employed only on an exception basis. For example, it may be useful to repeat the last payroll on a borrowed computer and then manually handle terminated and new employees.

3. Other Installation By Mission

This strategy is employed for enterprises that operate more than one installation. Each may be charged with acting as the backup site for the other. The charge will include having adequate capacity to do so. This may result in some redundant capacity across the two sites. Such capacity would be used only for work that was clearly discretionary. At any rate, each site by shedding its discretionary work would be able to perform the critical work of the other.

Additional strategies would be required for portability and communications and distribution.

4. Other Installation By Agreement

This strategy may be employed both with other installations in the same enterprise or with independent installations. An installation would have an agreement, often reciprocal, with one or more other installations that they would make available a portion of their capacity in the event of a disaster.

It is recommended that no commitment be made or accepted for a significant portion of an installation's capacity. Thus, a small installation might rely solely upon a single large installation for all of its backup capacity, since the required capacity would represent only a small portion of the installation's total. On the other hand, a large installation would look to multiple large installations for a small portion of the total capacity of each. This would reduce the impact on the host installation and reduce the dependency of the guest on any one host.

It is also recommended that the agreement be in writing and that it include monetary considerations in addition to reciprocity. The guest should expect to pay for capacity actually used even though he has also agreed to be a host. Such agreements are more equitable, enforceable and easier to justify to management.

5. Data Servicers

A special case of the above strategy involves the use of data servicers for backup. Data servicers are in the business of providing similar services. They are well equipped to enter into contracts. Their services are offered on a competitive basis and can be expected to be fairly priced. Data servicers are accustomed to having other people's data in their shops, so they will not find it disruptive and will be able to provide appropriate security.

They often operate large centers with multiple CPU's so that additional work will be less disruptive.

In conjunction with this strategy, consideration should be given to using the data servicers for off-site data storage and for peakload processing. This may justify communication facilities that will also be useful at backup time.

6. Portable Operating System

An essential portion of the operating environment that you must be able to reproduce in the backup site is the operating system. One strategy for doing this is to make the local operating system portable to the backup site. This strategy will require that the hardware environments be at least compatible. Minor differences may be compensated for by doing an I/O configuration generation of the operating system. This strategy will be most effective when only one or two sites are required for backup. When multiple sites are involved, the portability of the operating system may be enhanced through the use of a virtual machine operating system - e.g., VM/370. Such an operating system may be used to make diverse hardware environments appear to the operating system as its native environment. This strategy will consume some of the capacity of the host system and this must be considered in making capacity requirement estimates.

7. Compatible Operating Systems

In this strategy the backup jobs are run under the normal operating system of the host installation. Care must be taken to insure that the job will indeed run in this environment. Care must be taken to select only those sites which run a compatible system and that compatibility is maintained. A greater frequency of testing may be indicated for this strategy.

8. Distributed Processing

In this strategy redundant hardware and data are distributed over two or more sites to reduce response time, improve reliability and productivity and to reduce the consequences of a disaster. Normally, an application must be sensitive to all of these things in order to justify the additional cost. However, this strategy must be considered for all high risk applications.

9. Alternative Data Entry

It is frequently useful in the backup environment to be able to enter transactions or activity in a form different than normal. For example, a transaction may normally be entered at a terminal, transmitted over a leased line, and passed to the application program in an input message buffer. In a backup situation it may be useful to be able to mail them in, keypunch them and enter them through a card reader.

The flexibility to permit this may be provided by the application, by the communication monitor - e.g., with proper application design, an IMS transaction from a communication line or a batch monitor can appear the same to an application program - or by an access method.

10. Networking

One strategy for providing communications backup is to have the primary and backup sites as nodes in a commmon network. This strategy is most applicable to multiple installations in the same enterprise.

The requirements of this strategy will involve redundancy in the network. Care should be taken that the cost of such redundancy is justified by the reduction in risk. Consideration should also be given to the use of vendor-supplied value-added networks. Such networks cannot only provide device and protocal independence, but they can be used to rapidly connect a backup location to terminal locations.

11. Alternate Leased Terminations

When all of the links in a network terminate in one common location (e.g., central site), considerations should be given to having them also terminate in a second close-by location that might be suitable as a back-up location. This will only marginally increase the cost of the network, but it will significantly reduce the risk that the network cannot be used.

12. Dial-For-Lease

Another strategy useful for leased lines is to backup the private leased network using the public switched network - i.e., maintain the capability to establish a dial connection whenever the leased link fails. This capability is normally provided using a switchednetwork backup feature on the modem.

Alternatively, one may employ an additional modem at each remote site and a limited but expandable number of modems at the central site. This strategy will provide operational backup for a link failure on a day-to-day basis. In an emergency the number of central site local loops and modems could be expanded to provide disaster backup.

13. Voice-For-Data

In this strategy a voice phone call is substituted for a data link for the purpose of an inquiry or a transaction. It is useful for operational backup where one location has lost data communications but still has voice communications. Such a location can call another location for backup. For disaster backup this strategy may be limited in effectiveness but far better than nothing.

14. Mail, Courier or Messenger for Voice

It is important to remember that we did do business before the telephone and the computer. While it is true that some of today's institutions would not have been economically viable without them, they can survive for short terms without them.

15. Data Backup

As recently as 25 years ago data was the most difficult resource to recover. If remote natural copies of the data did not already exist, no provision could be made. Even when photo copiers came on the scene they were generally too expensive to apply to a problem that would show up only once every 1000 years. Even when cost was not prohibitive, the time required was still too great to be effective.

But the one thing that computers do best in all the world is to produce cheap, dense, portable copies.

Therefore, in modern systems, data (the most unique resource) can be made the easiest resource to recover.

Data, which is in itself an asset, which is essential to the equities of stockholders, customers or employers or which will be necessary to resume operations, should be identified by a functional analysis. This identification will normally be done by the data owner with assistance from staff.

This data will include items, such as stockholder records, product plans and specifications, descriptions of the plant, pension and payroll records, cash and accounts receivable data. It will exclude most historical and statistical data. From a DP perspective it will include the recovery plan with its appendices, procedures, such as programs and job control language (JCL) and necessary documentation.

It should be noted that this data does not include data retained only to meet legal requirements. Such legal requirements prohibit you from destroying or discarding the data, but they do not impose upon you any special requirements to protect it or to make special copies of it.

Whenever natural copies of this vital data do not already exist, then special copies should be prepared and dispersed to a distant site. The special copies should be on magnetic tape in a popular format - e.g., 6250 BPI. It is desireable that the data be in a logical rather than a physical format - for example, backup of diskpacks should be prepared using EXPORT rather than DUMP/RESTORE, since you may wish to employ different devices in the backup/ recovery situation.

The site for storage of backup data should be selected such that it is not subject to the same event as the primary site. Consideration should be given to storing backup data at the backup site. This may be particularly attractive if the backup site is a data servicer. The data should be refreshed on a frequency appropriate to the rate of its change and the level of residual risk you are prepared to assume - e.g., in an on-line order entry application, the on-order file is shipped off-site weekly. The risk is that in recovery five days of activity might have to be re-processed.

No single one of the above strategies will be totally responsive to all of the requirements of any installation. Indeed, the strategies most useful for any installation will be those which take advantage of factors unique to that installation. Nonetheless, some combination of the above will be responsive to most of the requirements of most installations.

III.

Recovery

Recovery is the temporary or permanent restoration of a critical mission capability. It is normally the responsibility of the provider of the service.

It requires that the components of that mission capability be identified. For example, the mission capability of the data processing operation is normally composed of some combination of people, plant, communications, DP equipment, supplies and data.

For each of the identified resources it is necessary to have a strategy for its recovery. In other words, the mission recovery strategy is to divide the capability into its components and have a separate strategy for each component. Historically, few missions have lost all of these resources to a single disaster; but, since each is essential, the loss of any one may put you out of business.

In general, the strategy for each component should be based upon multiple alternative sources of supply. Multiple alternative sources are used to limit the risk associated with any single source of supply. Normally, this approach will be more cost effective than attempting to limit the risk associated with any single source of supply. The appendices for such strategies will include descriptions of the resource, lists of the alternative sources & the names & telephone numbers of the supplier contacts.

A. **People**

Your people are your most unique resource. Their training, knowledge and experience make them critical and perhaps indispensable. Therefore, most strategies for recovery must assume some survival. This assumption is reasonable as long as all of your people are not often all on site at the same time. In operations where all personnel are on site at the same time a risk that recovery may be impossible must be assumed.

Other sources of people for recovery include other sites or locations, and contractors or vendors. These will include equipment manufacturers, data servicers, facilities managers and temporary employment services.

The strategy should spell out the survival assumptions, the skills and quantities required, and the sources to be employed for each skill. It will also describe how people are to be notified of what is expected of them. Of course, this will require a telephone list.

B. **Plant**

Physical plant for the data processing mission may require large quantities of undivided space, raised floor and exceptional amounts of cooling and power. Often it must be near the mission supported and it must be within the normal commute of the people who work there.

Management must identify the space requirements for the recovery.

Alternative space will include other owned space used for missions that are readily displaceable. Management may wish to make changes in such space in advance to improve its useability for recovery.

For other owned space DP management will look to the plant and facilities staff. Indeed, where the quantity of other owned space which might be suitable is large and the plant and facilities staff is adequate, then DP management may have a strategy that involves describing the requirement to the plant and facility staff in advance and looking to them in the event something happens.

Other alternatives will include other space in the community which, while not owned, might be suitable and might be available. Such space may include vacant office space, warehouses, school gymnasiums, church halls and airplane hangers.

For non-owned commercial space in the community management may establish relations with a commercial broker, who is retained to keep track of suitable space and negotiate for it in the event it is needed.

For other non-commercial space in the community, such as schools or hangers, management must keep a list of the names and phone numbers of the individuals who control that space.

Since it will not normally be cost effective to reduce to an acceptable level the risk associated with any one location or resource, prudent management will wish to identify multiple sites and sources.

C. Communication Facilities

Communication facilities are semi-permanent and so may be treated as part of the plant, like power. However, to treat them so may reduce the options available. Therefore, it may be useful to treat them separately.

Communication facilities may have long lead times which can be shortened only marginally in the event of a disaster. The more widespread the disaster, the longer the recovery time. Management should determine from the common carrier the estimated time required for recovery and some indication of the uncertainty involved. Comparison of this time to the recovery objectives will indicate whether or not an interim communications recovery strategy is required.

Often there are only one or two sources of supply, though there may be multiple substitute or alternative services. Required services may include leased data lines, dial-up lines, mail and messenger.

The appendix for the communications strategy will describe the permanent facilities to be recovered. It is useful to document these facilities in the form of pre-written service orders to the common-carrier utility. This may reduce recovery time by a day or more.

The appendix will also describe any temporary facilities to be used and their sources.

D. DP Equipment

DP management often focuses recovery planning effort on DP equipment. Since DP equipment is more readily interchangeable than people, more portable than plant and has shorter lead time than communications; this can be very misleading. Nonetheless, it often happens because the DP manager sees his equipment as being his most unique asset.

For the most part, DP equipment is modular, portable, similar (fungible) and, at least in emergency situations, has short lead times. On the other hand, if management has old, unique or obsolete equipment or hardware dependent applications; then special strategies may be indicated.

The appendix for the equipment recovery strategy will describe the machines to be recovered, the vendors, and the vendor contacts.

1. One-For-One Replace

The most obvious strategy is to replace lost or damaged equipment on a one-for-one, box-for-box basis and from the original vendor. Most vendors will make a special effort to replace equipment lost in an emergency and the record of response is outstanding. This strategy is the easiest way to deal with hardware dependent applications.

2. Many Small-For-One-Large

Under this strategy one large system is replaced with capacity made up of several smaller machines. Often this is an interim or temporary strategy. Management may wish to consider this strategy when the objective recovery time is less than the expected installation time of the larger machine. It should also be considered when suitable plant may not be readily available for the larger machine. For example, large scale machines may require more undivided space, motor-generator sets or chilled water not needed for intermediate scale systems. Where any of these are not available on the required schedule, then "many small-for-one-large" may be attractive.

3. Accelerated Upgrade

When an upgrade has already been scheduled at the time of the disaster, then it may be attractive to accelerate the schedule for the new equipment. The new equipment is installed early rather than do a "one-for-one" followed by the planned upgrade. In this way part of the unplanned cost of the disaster may be offset against the planned cost of the upgrade.

4. Application Change

This strategy involves changing the application so that it will run on different equipment. It is employed when the damaged equipment is not readily relaceable - i.e., unique, RPQ, old or otherwise scarce.

While this strategy may be risky, expensive and time-consuming it is viable and flexible. The risk, cost and time must be balanced against the value of doing the application in the scarce equipment in the first place. Normally, such value is related to the fact that the equipment is specific to a high volume application and, therefore, very efficient, or it is owned under very attractive terms or both.

Of course, the risk, expense and time can be diminished in the event of the disaster by spending some money in advance. For example, the application can be written and tested for more readily available equipment even though in the absence of a disaster the scarce equipment is still used.

E. Supplies

While DP management may over emphasize the importance of DP equipment, they often overlook the importance of supplies.

Supplies have lead times measured in weeks. Though these lead times can often be shortened in emergencies, they may still exceed the recovery time of hardware. Where the application is form dependent - (e.g., payroll, payables, billing, stock transfer, dividends) the availability of the form may be the controlling factor. For example, the last capability recovered after one fire was that represented by envelopes and mailers with the new return address.

The appendix for the supplies strategy of the recovery plan will include names and order quantities of the various forms, vendors and vendor contacts. It is also useful to include samples of the forms in the appendix. It facilitates communication with the vendor. While there may be only one such card with an upper right hand corner cut in an installation, the vendor may supply hundreds.

1. Staging

Staging is a strategy that provides for multiple supplies with only a current supply near the DP center. For example, a large public utility with a large daily billing run has a 1-3 day supply of forms in the DP center and a 30-45 day supply in a storage location six miles away. A bank with a large daily statement run has a one day supply in the computer room, a two week supply in the basement, a 30 day supply in a local vendor warehouse and an additional supply in the vendor plant location warehouse.

2. Multi-Vendor

This strategy says that if you normally buy the same item from two or more different sources, then you may have improved its overall availability and specifically its availability in an emergency situation.

IV.

Contingency Planning Process And Documentation

Contingency planning should be a part of formal planning. It is effective because it coordinates the efforts of different departments and functions. However, like other plans, a contingency plan has a short shelf life. It is environmentally dependent and changes in the environment make it obsolete. Therefore, to remain effective the plan must be updated on a regular and frequent basis. Since this updating will require the cooperation of all departments and functions, it follows that the contingnecy plan should be a part of the normal planning system and system of plans.

Not all organizations employ systematic planning. Many seem to function very well in "response mode" with only limited ad hoc planning. Such organizations are uniquely well equipped to deal with disasters on a similar basis. Their contingency planning can safely be limited to data base backup and distribution of the telephone list.

As with most planning, the process may be more important than the product. That is, what the managers learn in the planning process may be more important than the document that is produced. Therefore, all managers should participate in contingency planning.

Such plans should exist for all functions and levels. To be most effective each plan must compliment the other plans in its environment. Therefore, the plan of one department, function or level must include all others among its assumptions. Failure to do this may result in incompatible strategies or multiple claims upon the same resource.

It is useful to have separate plans for emergency, backup and recovery. Each plan can usefully be divided into the following sections: 1) purpose & description 2) objectives, 3) assumptions, 4) strategies and 5) appendices.

A. Purpose and Description

This section of the plan states the reason for preparing it and describes its content and its relationship to the system of plans. The reason for preparing the plan may be specific management direction - e.g., a specific policy, standard, guideline or directive. It may simply be a recognition on the part of the preparing managers that it is "good business".

This section should also include a description of the remaining portions of the plan.

It describes the relationship of this particular plan to the organizations systems of plans. For example, it may say that the backup plan is one of the contingency plans that are part of the information system plan which is part of the functional plan of the operating unit.

This section will also describe the relationship of this plan to the planning system. It will describe who is responsible for it, what its scope is, what standards it must meet, how often and by whom it is to be reviewed and how often it will be updated.

This section of the plan should be adequate to enable general management to test the adequacy of the remaining sections of the plan.

B. Objectives

The objectives section of the plan states the results that management expects to be able to achieve by having the plan in place. For example, the objective of the emergency plan may be to detect and respond to (specified) emergencies so as to preserve the mission capability. The objective of the backup plan may be to be able to accomplish (specified) critical applications or jobs in the absence of (specified) services or capabilities for a (specified and limited) time period.

The objective of the recovery plan may be to recover a (specified) capability to include (specifics) within a (specified and limited) time period.

Note that the objectives of one plan must complement those of the others. It is not effective to say that backup will last for a week but recovery will take two weeks. On the other hand it is not efficient to say that backup will last for two weeks but recovery will only take ten days.

The objectives should be stated in measurable terms. Then not only will you know after the fact whether or not the plan was successful, but the requirement to make them measurable will force them to be rational. It will avoid the tendency for the objectives to be unachievable and thus incapacitating. It will improve the odds that the plan will function successfully.

The objectives section of the plan should be adequate to enable functional management to select cost-effective strategies and to enable general management to test the adequacy of those strategies.

C. Assumptions

The assumptions section of the plan describes the extent, scope or limitations of the contingency to be dealt with and the environment in which the plan must function. For example, a plant of a worldwide corporation may have to resume operation after any event short of the end of the world. On the other hand, the data center for a rural bank need not survive the loss of the banks other assets.

The planning assumptions given to the managers of more than a hundred data centers in a worldwide corporation instruct them to focus on total loss of the center, but permit them, with one exception, to assume that the loss will be limited to their own center. The exception is for five centers which are located along the San Andreas fault.

The section should also describe the environment in which the plan must function - i.e., is the supporting economic infra-structure intact and functioning. In disasters limited to a single location extensive community resources will be focused on the victims. Indeed suppliers will be hyper-responsive and will even absorb some additional cost associated with aiding the victims. Backup and recovery will be facilitated. In a more widespread disaster, not only will these additional resources not be available, but normal services may not even be available. The assumptions must speak to these issues.

Finally, the assumptions will speak to risk. They will speak to the risk inherent in the plan itself - i.e., that it will not function as written or that functioning as written, it will not meet its objectives. It should also speak to the residual risk that will exist with the plan in place. This risk is the sum of the plan risk plus all risks that the plan does not address.

This section must be adequate to enable general management to accept the risk. It must give adequate guidance to functional management to enable them to select cost-effective strategies consistent with the level of risk accepted.

D. Strategies

This section of the plan describes the steps that management will take in order to accomplish the objectives.

In order to achieve the lowest risk at the least cost, such strategies should be based upon multiple alternative courses of action. There should be sufficient alternatives to achieve an acceptable risk, but not so many as to introduce unwarranted cost or complexity. The plan should describe how resources will be allocatd across alternatives. It should also describe the decision points and criteria that will be used in making them.

In other words a strategy is not a series of steps followed in a definite order, but rather a pre-determined series of choices.

For example, when the small child falls into the well, massive resources will be marshalled. They will be applied to a number of possible rescue methods in parallel rather than in series. A fireman or rescue specialist will be lowered into the well, a parallel shaft may be started and air may be pumped in all at the same time. The rescuers will not wait to begin the air and the parallel shaft until the attempt at lowering someone has failed. The longer the start of those two attempts is delayed, the lower will be the chances of their success. Within the limits of resources and complexity, the more options employed, the greater the chances of ultimate success.

If one has a list of six or seven suitable sites, the chances that one will be available is greater than with two or three. On the other hand a list of twenty probably is not a great deal better than six. It will not provide a substantial reduction in risk and will be more difficult to manage.

As is shown in the discussion of emergency, backup and recovery plans, it is useful to organize strategies along the line of objectives and sub-objectives. Thus, the emergency plan will have alarm and containment strategies, the backup plan will have strategies organized by application and environment, and the recovery plan will employ strategies organized according to the resources that make up the mission to be recovered - e.g., people, space, equipment, data and supplies.

Two other strategies are required. They are the security strategy and the testing strategy. The security strategy is required for the backup plan and optionally for the recovery plan. It will deal with how security will be provided for in the backup situation.

Management will normally be prepared to take a higher level of risk in the limited context of disaster backup. However, vulnerability may be extremely high after a disaster, since it may have been deliberately caused and because your resources are already strained. For example, you may have brought the backup data - i.e., the last copy - into the backup site.

Therefore, a strategy should be included to provide security in the backup location. Differences in risk between the primary and recovery locations should be accounted for and accepted by management.

The emergency, backup and recovery plans should contain strategies for their own testing. The test should enable management to satisfy themselves that the plan will work if needed, and to identify the need for adjustments to the plan. The strategy should enable the plan to be tested in an inexpensive and non-disruptive manner. Since some strategies are inherently easier to test than others, the requirement to test must be considered when selecting the strategy.

Emergency plans are usually tested by drills. The alarm is signalled and resources are evacuated or sheltered as indicated. The effectiveness is observed and recorded and necessary corrective action is taken. It is normally satisfactory to test such plans semi-annually unless significant variances are noted.

The backup plan may be tested by similar drills in which the disaster is hypothesized and the strategies are exercised. However, in order to contain cost and limit the effect on the mission capability, the backup plan should be tested one application at a time. Key applications should be tested at least annually or when there are significant changes to the plan or the environment.

The test should demonstrate that all critical jobs can be started and that one or more run to completion.

The recovery plan should be tested by limited drills one resource at a time. This is the most expensive plan to test exhaustively, but the least likely to be needed. Therefore, it is normally tested by contacting the vendors, and interrogating them as to their ability to respond on that day. For example, you might interrogate plant and facilities about the availability or lead time for suitable space. All resources should be tested at least once every two years or when there are significant changes to the plan or the environment. These strategies should be adequate to ensure that functional management will know what do do and to enable general management to assess their risk against objectives.

V.

The Appendix Section

The appendices will include all of the data that is required to carry out the plan. While the other sections of the plan may be more substantive, this section will have the largest quantity of data and be the most dynamic.

The appendix section can be expected to have one or more sections for each strategy. For example, the appendix for the emergency plan may contain the names and phone numbers of people to be notified in the event of alarms, as well as the names of people authorized to take specific decisions or actions. The appendix for the backup plan will contain lists of critical and discretionary jobs, names and phone numbers of responsible individuals, sources of alternative capacity and names and phone numbers of key contacts.

The appendices for the recovery plan will contain lists of required resources and lists sources for each resource.

These appendices should be updated to reflect any changes to the underlying data. They should be updated at least monthly or whenever there are significant changes to the underlying data.

The quantity and volatility of this data makes it a good candidate for a database application. The candidacy is supported by the recognition that the proper organization of this data cannot be known until the date of the disaster is known. For example, Figure 1 shows the data that might be recorded about a job. The critical jobs will come from among jobs with all frequencies. Until the date of the disaster is known, it will usually not be known what the critical jobs are or possible to give each individual a list of the jobs he should see to.

FIGURE 1

Application:
User Department:
Job Identification:

Frequency: Daily_____ Weekly_____ Bi-monthly_____ Monthly_____
Annually_____ Other_____

Schedule (by date of the period):

Priority:
Critical:
Reason (required): Cash Flow_____
Product Flow_____
Billable Services_____
Other (explain in remarks)_____

Discretionary:

Other:

Resources:

Configuration:

Operating System:

Capacity:

File Names:

Form Names:

Instructions:

Responsibility:

To Run Back-Up ______________________________

User Manager ______________________________

DP Contact For ______________________________

Data ______________________________

Forms ______________________________

Other (specify in remarks) __________

Remarks:

SOFTWARE: MAKE OR BUY

A NEW SET OF RULES FOR THE 1980's

Joseph A. Catrambone
University of Illinois

James "Pete" Fox
Old Dominion University

Cecil J. Hannan
San Diego Community College District

Willitt S. Pierce
University of Illinois

William Mack Usher
Oklahoma State University

This panel discussion focused on the issues arising from the fact that increasing numbers of universities, faced with the development or replacement of information systems, are considering the acquisition of commercial packages and/or adoption of facility management as viable alternatives to internal development. These alternatives hardly existed ten years ago, but may become the rule rather than the exception as universities strive to improve productivity during the '80's.

The notes which follow reflect the individual panelists' contribution to the discussion at the CAUSE 80 Conference.

CAUSE: A New Relationship for the 1980's

During the 1970's, CAUSE's relationship with its member institutions has been of information exchange and professional growth. The initial intent for establishing CAUSE was to provide application system description, institutional profiles and general system information to promote the sharing of applications among its members. Finding ways to enhance professional growth among its member institutions by providing professional conferences, seminars, and monographs has been the motivating factor for establishing a "new image" for CAUSE.

What new relationships could be established between CAUSE and its member institutions which would promote the further sharing of application software? The current relationship between college/universities and software vendors as they relate to the development of application software are of four general types. Namely, the installed user product, the joint development, the modular enhancement and the adaptation or conversion. Some examples of these relationships are the DUKE/IBM Hospital online order communication system, the Illinois/Arthur Anderson online alumni/foundation system, the Indiana/IAI financial aid system and the Illinois/Technicon online hospital order communication and reporting system. While these are good cooperative ventures between institutions and software vendors, usually only two parties (one institution and one vendor) are involved and share the benefits. Why not involve more institutions? The University of Illinois Alumni/Foundation System will cost over a million dollars and will take four years to complete. Personally, I wish there were other institutions and a software vendor committed in the development of our Alumni/Foundation System. Such a commitment would have reduced the development cost (per institution) and time, and could reduce the "everlasting" cost of maintenance. How could CAUSE assist in promoting this concept of cooperative software development between multiple institutions and a software vendor? As I personally see it, CAUSE could be involved in various degrees or levels. These levels comprise coordination, legal entity, and marketing enterprises. At the first level, CAUSE could continue in a coordination role by surveying institutions; application systems needs and activities with vendor interest. That is, CAUSE could bring the interested institution and vendors together. CAUSE could become further involved at the second level (the legal entity) by carrying out the contract negotiations between the institutions and vendors. In this mode, CAUSE would administer the contract and handle the software distribution. The third level of CAUSE participation would include the marketing enterprise. Yes, CAUSE would handle the publicity, sales, implementation coordination, and even the royalty distributions. Why not? With runaway inflationary costs to develop and maintain application systems, we may all need each other to survive the 1980's. Why not have CAUSE act as the catalyst and promoter for this survival?

Joseph A. Catrambone
University of Illinois

Make or Buy: A New Set of Rules for the 1980's

J. C. Fox
Systems Analyst
Old Dominion University

INTRODUCTION

The purpose of this paper is to summarize the administrative problems caused by some common system development approaches used during the 1970's. After summarizing the problems, there is a discusion of some general objectives for new systems-the systems of the 1980's.

There is a discussion on the improvement alternatives used to obtain the new systems and some criteria useful in evaluating the improvement alternatives. An evaluation matrix is presented to show how the evaluation criteria can be related to the improvement alternatives to assist the evaluation process.

SYSTEM PROBLEMS FROM THE 1970's

The rapid growth experienced during the 1960's and the 1970's by institutions of higher education and the state of the art in system development techniques had a significant impact on the solutions developed to meet the perceived problems. Frequently, the solution was to automate a specific data collection or decision process without regard to how that process was related to the other administrative functions. Evidence of this approach can be found in the many articles which document case histories of the development of specific systems without discussing the impact on related administraive functions.

Many existing, inadequate systems are the result of development methods that were designed to meet short run objectives with little consideration for related administrative functions. These systems are characterized by:

1. Information systems that are not effectively interfaced.
2. An abundance of manual systems. An important clue is the use of manual systems to perform critical functions despite general agreement that the functions could and should be automated.

3. The existing system(s) are approaching their useful limits. They have reached the limit of their flexibility to accomodate new requirements.
4. External demands change periodically . You find that you are still working on last years changes when this years changes are announced.

In summary, many of the systems of the 1970's were developed a piece at a time to meet then critical needs. Consequently, the system(s) do not perform optimally in the current environment.

During the mid 1970's, there evolved a recognition and a solution for the "specific systems" problem-Management Information Systems(MIS). The MIS approach is well documented and the growth of data base management systems (DBMS) can be linked to the acceptance of the MIS approach.

OBJECTIVES FOR NEW SYSTEMS

Beyond the obvious objectives, there are at least three general concepts which should guide the acquisition of new systems. The intent of these is to provide a long run, comprehensive approach to administrative functions. These concepts are:

1. Buffer users from external changes by acquiring flexible systems.
2. Provide integrated systems which relieve processing bottlenecks and reduce timing constraints.
3. Automate the obvious functions such as data collection and routine tasks.

IMPROVEMENT ALTERNATIVES

During the 1960's, institutions faced a limited set of system improvement alternatives. The computer hardware and software industries were relatively new. Consequently, the products and, more important, the people behind the products were just beginning to develop.

Then during the 1970's, a number of new alternatives were developed and perfected. The hardware and operating systems reached a high level of sophistication and reliability. These achievements allowed software firms to develop equally sophisticated and reliable products. For example, the following are available alternatives:

1. Purchase an existing software product.
2. Acquire and modify an existing product from another institution.
3. Contract with a software firm to design, program, and install a custom system.
4. Contract with a management consultant to develop and install a system.
5. Use in-house resources to develop a new, comprehensive system.
6. Use in-house resources to improve the existing system(s).
7. Utilize a facilities management group.
8. Utilize a service bureau.
9. Join a consortium of other institutions and use one of the above alternatives on a shared cost basis.

CRITERIA FOR AUDIT SOFTWARE EVALUATION

Each institution must consider its environment and resources to determine the best improvement alternative. Below are some criteria which are helpful in making a final selection.

1. Expense.
    a. Hard dollars.
    b. Internal resources (soft dollars).
    c. Opportunity costs which will be incurred by diverting people resources.
2. Compatability with existing data.
3. Compatability with hardware and operating system.
4. Efficiency in a production environment.
5. Edit capabilities, most commercial systems are driven by a data element dictionary.
6. Proven portability if this is a product being acquired from another organization.
7. Documentation that is available.
8. Maintenance options.
9. Access to a user's group.
10. Evaluation of the final product.
11. Total time required to install the system.

Attachment A is an evaluation matrix example which combines the selected criteria with selected improvement alternatives to assist in the selection process.

IMPROVEMENT ALTERNATIVES
EVALUATION MATRIX

1 = Least attractive.
6 = Most attractive.

	PURCHASE	ANOTHER INSTITUTION	SOFTWARE FIRM	MANAGEMENT CONSULTANT	IN HOUSE MAJOR DEVELOPMENT	IN HOUSE ON-GOING IMPROVEMENTS
COST - EXTERNAL	3	4	2	1	5	6
COST - INTERNAL	4	3	5	6	1	2
IN-HOUSE FINANCIAL RESOURCES	5	3	2	6	1	4
IN-HOUSE COMPUTING RESOURCES	4	3	5	6	1	2
TIME TO IMPLEMENT	5	4	3	2	1	6
FINAL PRODUCT	6	5	2	4	3	1
	27	22	19	25	12	21

FACILITIES MANAGEMENT

Facilities Management - Defined - You hire a company to manage in-house computer resources.

How does an FM contract impact the purchase or development of software?

Either purchase or development may be more efficient under FM.

Why? - Because you don't have to repeat the errors in implementation that others have made.

In San Diego we made a deliberate decision to purchase software for our major administrative systems.

The major reason: Less expensive; could be accomplished in a shorter time frame.

In the past 18 months we have installed a new Payroll/Personnel system - Information Associates.

A Student Information System - SCT

A Fund Account System - SCT

SCT is also our Facilities Manager.

In each software case, we selected the lowest responsible bidder.

All of the new systems have significant on-line components and are comprehensive.

We have encountered only minor problems in having our FM vendor install another vendor's hardware. In fact we had no problems at the technical level. The only problem at the policy level was in protecting the proprietory interests of the parties.

Without our Facilities Manager we could not have installed 3 major systems in such a short time span -- not to mention the fact that we also installed a new main frame and peripherals.

Our FM relationship instantly produced help when we needed it. The help came from either SCT corporate headquarters or from another institution.

In our implementation we never missed a task deadline.

Other than results in implementation what is different in the shop? Not the rank and file staff. They are still there. Only the top level management changed. What is new is a carefully managed operation that includes detailed procedures - frequent skills training - and instant access to specialists for short-term assignments.

It is all working for us.

Our 8,000 employees are being paid. We are in the midst of registering on-line more than 94,000 students who will attend the classes we teach on our campuses and in 400 locations. We finally know how many students we have, what classes they are taking, and where they are taking them.

Somehow our managers failed to obtain the value from our computer operation - that SCT has. At any rate FM is working for us.

Here are three rules based on our experience others might find useful in the 1980's:

1. When you are doing a less than effective job - admit it.
2. Hire top talent or a company that has top talent.
3. Write contracts with vendors carefully.

C. J. Hannan
San Diego Community College District

METHODOLOGY, OR PROJECT MANAGEMENT METHODOLOGY

Methodology is software. We all have it whether well or poorly documented. Increasing complexity of the application development process and concern for productivity motivates towards standard, repeatable processes. The effort to perfect and document these would strain the capability of most organizations. Fortunately, entrepreneurs being what they are, several project management methodology products have appeared on the market - SDM 70 and SPECTRUM-1 for example.

What then are rules for the 80's with respect to the make or buy methodology issue. While perhaps not new rules the following suggestions are worthy of your consideration:

1. Execute choice as you would any other make or buy decision - requirements, evaluation criteria, array alternatives, evaluate and decide.
2. Broaden the scope of your project management methodology
   a. beyond the boundaries of EDP to include all players - users, vendors, auditors, etc.
   b. beyond the scope of a specific project.
3. Expect your methodology to be changing, dynamic; therefore consider participation in its evolution as a sponsor.
4. Coordinate your application development scehdule, project management methodology and training program.
5. If increasingly you find yourself acquiring packaged application software, then ackowledge that that itself is a strong reason to consider a project management methodology package. ... a natural step in the direction of industry-wide standards.

Willitt S. Pierce
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STANDARD SYSTEMS DEVELOPMENT PRACTICES:
A KEY TO PRODUCTIVITY AND SURVIVAL IN THE 1980's

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Increased individual productivity in the near term and increased institutional productivity in the long-term can be achieved by utilizing standard system development practices. This paper is intended to introduce the concepts and components of effective standard practices for planning, designing, installing and maintaining information systems. Three overall areas are covered in the paper: the system development life cycle, system project management practices and structured techniques in system analysis and implementation. The critical components and considerations in the system development life cycle are discussed. Project planning and control techniques and quality assurance requirements are covered as components of effective system project management practices. The structured techniques of structured analysis, data analysis and structured design and programming are introduced. Finally, the benefits of and objections to the use of standard system development practices are reviewed.

STANDARD SYSTEMS DEVELOPMENT PRACTICES:

A KEY TO PRODUCTIVITY AND SURVIVAL IN THE 1980's

The information processing profession has become a high risk business. The objective of this paper is to introduce the concept of standard system development practices which, we believe, will reduce the risks. Standard system development practices will increase individual productivity in the near term and institutional productivity in the long term.

Numerous environmental factors are affecting information processing departments today. Factors including rapidly increasing sytems complexity, development costs, application backlogs, user expectations and processing alternatives combined with rapidly declining hardware costs, user tolerance and the acceptability of budget increases represent external influences on information processing departments. Environmental factors internal to information processing departments relate to increasing complexities and personnel needs. Hardware and communications networks, system software and information processing organizations to effectively manage these resources have become substantially more complex. The availability of information processing personnel is falling far below projected demand. As a result, retention, internal communication and training are becoming increasingly important. Combined, these environmental factors are exerting significant pressures on information processing managers.

Administrators, users and information processing management each have different viewpoints and concerns. Administrators focus on the effectiveness and control of information processing dollars. They are concerned with project schedules and budgets which are not based on sound facts, cannot be used to determine specific project status and which do not take advantage of previous experiences. Users want some assurance that proper results will be achieved by systems projects. They do not want systems which are missing key information or functions, are difficult to use or produce erroneous results. Information processing management would like consistency in approach and system quality. They are concerned about project results which are difficult to maintain because the time required to identify and correct errors is excessive resulting in low productivity. Increasing system complexity and integration is also making maintenance costs excessive because so many programs and systems can be affected. All too often, information processing takes the blame. Administrators and users do not understand the problems because the work required to develop and maintain systems is not understood and they are not actively involved in the projects.

Structuring the environment provides a framework for the effective management of information processing. Structure in system development practices, production system support and operations management provides a basis for dealing with the concerns and environmental factors exerting pressures on information processing managers. Standard system development practices establish the structure for system development and support structure in system maintenance and system operations.

Standard system development practices are predefined standards which ensure the efficient organization and implementation of system projects. Standard practices dictate executive and user involvement and support hardware/software strategies and operations management. Standard practices support the needs of information processing personnel by formalizing communications, structuring training and promoting retention through defined career paths. As a result, risks are reduced and productivity is increased.

Standard practices can reduce the high risks in information processing management by improving user satisfaction and the effectiveness of information processing expenditures. Increased development productivity reduces system development costs. More maintainable systems reduce maintenance costs. Increased user involvement and satisfaction extend useful system lives thereby reducing system replacement frequency. In summary, individual and institutional productivity are increased.

Standard practices are comprised of system project management practices and structured techniques. System project management practices define the framework for performing and controlling system projects. They include defined development phases, work plans, project controls and reporting, quality assurance, documentation and user involvement. Structured techniques represent specific approaches to analyzing and documenting much of the work that is required during system projects. Structured techniques include structured analysis, data analysis and structured design and programming. Together, these practices address the entire system development life cycle.

Standard practices organize and structure the individual components of the system development life cycle into four phases. Organization and structure of the life cycle establish a common frame of reference which administrators, users and information processors alike can relate to and understand. The phases provide checkpoints for senior management reviews and project controls. With further definition of required activities within a phase, the skills required to perform the work can be identified. Finally, the phases and a common understanding of their components limits what must be committed to and estimated, to the work that can be foreseen. The four development phases in the life cycle are: systems planning, design, installation and maintenance.

The objectives of systems planning are to identify current and future information requirements and determine how these requirements should be met. By initially reviewing the total requirements, the availability, accuracy and thoroughness of the information important to support the entire University is considered. Resource usage is improved by minimizing redundancy in data, systems and development efforts. Information systems are designed which support the achievement of long-range University objectives. Information requirements are viewed in the context of the entire organization. Finally, the system plan serves as a benchmark for measuring development progress and establishes the priorities for design projects.

The design phase objectives are to determine how the system will be implemented to meet the University's objectives, and to obtain commitment to the system before the major portion of development costs, programming and implementation are incurred. Major benefits result from the design phase by answering the following questions:

- What will the system do from the users viewpoint?
- How will the system operate from a technical viewpoint?
- What are estimated operating costs and benefits?
- What are estimated costs and the timetables for installation?

The installation phase represents the most significant amount of work effort in all four phases. The objectives are to finalize the system design and successfully install the system in an operational environment with minimum disruption to users. During this phase computer programs are created, required procedures to operate the system are established, personnel are trained to use the system and the organizational and management structures to assure successful continuing operation of the system are established. At the conclusion of this phase, the system is turned over to operations and maintenance begins.

The objectives of the maintenance phase are to classify, analyze and implement system changes in a controlled environment. Maintenance activities usually require the majority of the information processing resources. Major benefits result in structuring the maintenance activity. The benefits include: production system changes which are implemented effectively and with minimal user disruption, maintenance activities which support administrative needs, and production systems which operate efficiently and are easy to modify.

The four phased approach permits management to review the prospects for proceeding to subsequent phases with only minimum work to support a decision in each phase. The requirement for senior management approval at the end of each phase prevents large expenditures of effort for systems of little merit. The four phases and the segments of work within them set the stage for the remaining components of system project management practices.

Standard work plans document the tasks and steps that should be considered in each phase of the system development life cycle. Standard work plans include a responsibility matrix which identifies the roles of administrators, users and information processing personnel in a project. Specific responsibilities to perform, consult and assist, review and evaluate, and approve work steps are identified. Standard work plans provide assurance that necessary work tasks are not overlooked in the development of specific project work programs.

Several factors impact the development of specifc work programs from standard work plans. System size and complexity impacts project communication requirements and can reduce the amount of documentation required to ensure effective communication. Work plans are also impacted by the development or first-time use of system software, use of application software and data base management systems, development of on-line systems and the installation or first-time use of new hardware. The standard work plans become input to the development of specific project work programs.

Project work programs define the specific tasks to be performed during a specific project. Tasks and steps are defined in sufficient detail to describe the work required and work products expected. An estimate of the effort required to complete tasks and steps are included and estimated start and completion dates are added. Finally, individual assignments are made for completing the work. The project work program provides the basic input required for establishing control over project activities and for comparing planned to actual progress.

The purpose of project controls and reporting is to monitor and report progress throughout the project in relation to the work program. The key components of project controls are the project work programs, personnel time reporting and estimates to complete by task and step. Project controls provide for planning and controlling the total costs for data processing, including new system development projects and operational production systems. Project controls support the management of system development projects and the measurement of the performance and productivity of system development personnel. Project controls provide the basis for reporting to management the progress of projects.

Project progress should be formally reported to management each month. Project status should be reported to project management weekly. The progress report should include a summary of project status and problems or items requiring action. A barchart approach to illustrate the progress of the project can be an effective tool for management to monitor project status. Using the work program, time reporting and estimates to complete, an analysis of schedule performance and personnel efficiency can also be made. With these tools, projects can be monitored and management will be informed as to the status of system projects.

Quality assurance reviews provide management with an independent assessment of the quality of the work accomplished. The quality assurance program is designed to ensure the system: satisfies all user requirements on a day-to-day basis, is being developed within the timeframe and cost estimates originally agreed upon, is efficient and simple to operate, maintain and control, and employs satisfactory methods and techniques which are within the sphere and competence of the majority of personnel. Such reviews are becoming increasingly important as projects get larger and more complex.

Specific checkpoints are identified in the system development life cycle when the project is reviewed. Checklists are designed as a series of questions concerning the quality of the work being performed to serve as memory aids and ensure all relevant points are considered. Key checkpoints occur during: project initiation, project performance, precompletion and post installation. The results of each review should be documented.

The quality assurance review should be conducted by someone not associated with the project. The reviewer should be of equal or higher rank than the project manager and should report directly to senior management the results of the reviews. If management is unaware of the problems before they occur and a system fails, then the reviewer and project manager are equally at fault.

Standard documentation establishes the requirement for thorough, consistent and precise documentation which helps ensure effective communication between members of the development team and the successful completion of the systems project. Thorough documentation will ensure that the thoughts and ideas of all personnel involved with the system are communicated effectively. The same personnel seldom work on all phases of a project and documentation can avoid duplicated effort and wasted resources. Complete documentation assures management that no effort will be wasted if delayed projects are rescheduled.

Standard documentation is also important to maintaining systems. Documentation usually contains more details than can be completely understood or recalled by one person. Systems are not self-documenting. Current and efficient documentation must be available to answer user inquiries, correct errors or implement enhancements. Documentation should provide an overall explanation of the system and detailed information about all parts of it.

Key features of standard documentation are its enhanceability and reusability. Documentation can be enhanced as the project progresses if it is organized and well conceived in advance. Also, duplication of effort will not be necessary and fewer requirements will be forgotten. Once a working paper identifies and documents a part of a new system, it may become the basis for other working papers. Overall project efficiency can be enhanced by creating development working papers which can be utilized to maintain production systems.

Standard system development practices are structured to encourage the involvment and participation of users throughout the system development life cycle. This helps ensure that systems are developed to meet user's needs and minimizes the need for modifications after systems have been implemented.

Structured techniques support the achievement of the objectives of standard system development practices. The structured techniques of structured analysis, data analysis, structured design and programming help produce systems which cost less and better satisfy user requirements. Structured techniques focus on a top-down approach to assure minimum work is performed to meet the objectives of each development phase.

Structured analysis identifies and describes the business functions within a business area and then divides these functions into smaller, more manageable subfunctions that can be easily understood. It would not seem to be anything dramatically new since, in essence, it is an outline approach to identifying business functions and requirements. This outline approach has the benefit of emphasizing business functions and information needs rather than technical solutions. It encourages a complete analysis and it is easy to train inexperienced personnel in its use. Because the approach is simple, straightforward and concise, it supports excellent communications between users, management and the project team.

Data analysis identifies and describes data and their relationships using a top-down and graphical approach. The top-down approach assures that minimum work is performed and supports the ultimate objective of designing files or data bases. Data analysis is a methodical approach which supports on-line data base systems required by the needs for timely information and changing technology. The approach results in satisfying not only needs that users express at a given point in time, but also needs which might arise in the future because basic data doesn't often change. Methods of processing and reporting might change but basic data doesn't very often. The approach is easy to learn and relatively inexperienced personnel can be used to analyze data quickly. The format of data analysis is easily understood by both users and management thus increasing the quality of communication.

Structured design and programming relate to transforming functions and data requirements into technical specification; then operational programs, in a top-down, well defined process. The definitions have been put together because the distinction between detailed design and programming is less significant than it has been in the past. This is the area where the most quantifiable benefits of structured techniques appear. IBM talks about 30 to 200% productivity increases as a result of using structured design and programming. Structured design and programming can alleviate morale problems by promoting teamwork and providing the programmer with higher level specifications than in the past. The degree of structure presented a programmer can be adjusted according to experience and programmers can move into analyst positions quicker. Structured analysis and data analysis naturally support and flow into structured design and programming.

The top-down approach implied in the three techniques results in varying degrees of detail. Structured analysis begins at a very high level in system planning with an analysis of all of the top-level functions and the entire requirements. Structured analysis is completed in the user requirements segment of the design phase and the results are input to the remaining segments in the design phase. Data analysis starts in the system planning phase with some gradual refinements. Early in the design phase, data is left alone while the functions are refined by structured analysis. Data analysis starts up again as data elements are identified to support the functions. Elements are then consolidated into records, files or data bases. In the installation phase, the information processing characteristics of data is defined and intermediate files are designed. Structured design begins during the design phase to the extent that program modules are identified for purposes of estimating the installation. Structured design and programming continue during installation until all programs are coded, tested and system tested.

These are techniques that have been documented by various people--Warnier, Yourdon, Jackson, Orr, etc. The specific technique is not particularly important. The idea and the resulting benefits in terms of productivity and system quality are important when combined with the other benefits of standard system development practices.

The benefits of standard systems development practices are numerous, and if properly developed, address virtually every risk and problem facing the information processing manager in the 1980's. The benefits of standard systems development practices include:

- Requires user involvement which enhances user satisfaction and reduces rework and/or user discontent.

- Systems which have longer lives and therefore reduce the frequency of replacement which impacts the time and cost invested in systems.

- Increased staffing flexibility since standard practices provide a common base for people to move among projects with a minimum of start-up and re-invent time.

- Provision of a framework around which training programs can be designed.

- More clearly defined career progression patterns.

- Systems which are more easily maintained as a result of improved documentation and the use of standard approaches.

Standard practices put the entire system development process in an understandable fashion. Administrators better understand the requirements and problems associated with systems projects. They also better understand their role in the process and the products they are asked to review. Developers, likewise, better understand the tasks to be performed and the results or products expected. In summary, the presence of guidelines and standards enable people to concentrate on the real problems rather than perpetually re-inventing the wheel.

We have built one of the largest information consulting practices in the world with standard system development practices as its foundation. Standard practices are the basis of our training and career development. Standard practices provide us with a common body of knowledge and enable us to effectively move personnel among projects, offices and even countries. Although our experience with the use of structured techniques is somewhat limited, the productivity increases reported by others have been very impressive. It is with our foundation of standard system development practices that we believe we can and will double our consulting practice in the next five years.

The critics of standard practices complain that they take away creativity and initiative. System development is still an "art" subject to the influence of some "science." Judgement in the system development process can never be replaced and we believe the benefits of structuring the environment outweigh the objections. The objective of standard practices is to avoid re-inventing the wheel and to free individual resources to attack the real problems.

In summary, standard system development practices may prevent the information processing director from becoming an endangered specie. Standard system development practices including defined development phases, work plans, project controls and reporting, quality assurance, documentation and user involvement should be used to guide and direct the development and maintenance of information systems. Such practices focus on ensuring the efficient organization and implementation of system projects.

Quantitative and qualitative benefits can be identified with the use of standard practices. The quantitative benefits include reduced programming effort, fewer program bugs, reduced design effort and increased maintainability. Qualitative benefits arise as a result of the improved role definition for administrators, users and information processing personnel. Better "quality" systems in terms of reliability, understandability and maintenance can result by using standard system development practices.

HOW ELECTED OFFICIALS CAN CONTROL COMPUTER COSTS

Daniel B. Grady
Vice President
Board of Trustees
San Diego Community College District
California

HOW ELECTED OFFICIALS CAN CONTROL COMPUTER COSTS

All of us connected with public institutions are experiencing a time of fiscal stringency. Elected officials responding to the spirit of the times and to fiscal responsibility are guarding the expenditures of tax dollars ever more carefully.

Expenditures in the computer area stand out prominently in most government agency budgets. The need for new or added hardware, software, and personnel is often not understood.

Computer jargon and technology are difficult, if not impossible, for the uninitiated to understand. Hardware and software changes resulting from new technology confuse the layman and often result in raising questions about computer staff competence.

How do public officials make decisions about multimillion dollar computer operations? There is no quick mix method for becoming computer literate. There are, however, processes that might help decision makers head in the right direction.

First, a needs assessment. All potential uses should be subjected to a preliminary cost/benefit analysis. Mandatory items should be distinguished from those which are discretionary. Needs of management, students, and faculty should be carefully analyzed.

Next, data regarding the size, configuration, and cost of hardware required to meet tentative uses should all be reviewed.

Thirdly, a three-to-five-year master plan specifiying user needs, hardware, software, and personnel is essential. Again, each item should be subjected to a cost/benefit analysis. Decisions should be reached in the planning process that define the scope of computer activity and the systems for future decision making.

Finally, alternative ways of providing the computer service should be examined and subjected to a cost/benefit analysis.

I will briefly review six alternative approaches which are worth consideration.

ESTABLISH A RELATIONSHIP WITH A SERVICE BUREAU

The advantages of this approach are: (1) that you pay a fixed price for a specified service which may be either negotiated or bid; (2) an outside agency is responsible for the technical aspects of hardware and hardware operation; (3) software maintenance and development personnel can be employed by the service bureau, by the institution, or by other arrangements. Disadvantages include: (1) it is difficult to write needed controls into a contract; (2) less flexibility for users; (3) sometimes costs are higher; (4) equity in hardware does not accrue. The service bureau approach may best fit small institutions and certain functions in large institutions.

JOIN OTHER USERS IN OPERATING A COMPUTER CENTER

Form an organization with others of like interest to operate a computing center. This alternative has many of the same advantages and disadvantages as those we just reviewed and a few additions. The joint enterprise could be operated by a Board which would give users a stronger voice. An additional advantage could be a sharp reduction in software development or purchase costs. This alternative might best suit a large institution with a number of small institutions within a geographical area.

FULL IN-HOUSE PERSONNEL FOR HARDWARE OPERATION AND SOFTWARE DEVELOPMENT AND MAINTENANCE

Hardware is expensive. Purchase must be justified on the basis of use over time. The in-house development of sophisticated software may be the largest computer-related waste occurring today. A large administrative system, such as personnel/payroll, student information, and finance can be purchased at a fraction of the developmental cost. With few exceptions, software development outside of research makes poor economic sense. An institution has more or less full control of its own staff. That should be an advantage, but tenure like laws, makes shifts and changes difficult. In addition, institutional managers frequently lack the knowledge and skill to choose between competent and less desirable technical personnel.

PURCHASE SOFTWARE WHILE HAVING AN INTERNAL HARDWARE OPERATION AND A SOFTWARE MAINTENANCE STAFF

There is an important advantage to having a close relationship between a computing staff and users. Such a relationship is possible under any of the alternatives here reviewed but may be enhanced more by some rather than others. Careful development of needed software requirements can result in numerous vendor possibilities which, with little customizing, can result in a very usable product at a sharply reduced cost. Everyone does not need to invent the same wheel.

ENTERING A FULL OR PARTIAL FACILITIES MANAGEMENT AGREEMENT

Facilities management (FM) simply defined, means that the institution hires a vendor to manage all, or a portion of, their computer opeation. Partial facilities management, often referred to as shadow management, means that a company in the computer management business would bring in top-level computer personnel to manage your computer staff. Full facilities management would mean that a vendor would employ all of the computer staff and may or may not furnish the hardware as well. The San Diego Community College District, where I am a trustee, has a facilities management contract with the Systems and Computer Technology Corporation (SCT). Our relationship is working well for us so I may speak here with a modest bias.

Eighteen months ago, our computer operation was a near disaster. Costs were rising, demand for new equipment was rising, but neither as fast as the complaints from faculty, students, and managers about the inadequacy of the computer shop. Staff recommendations regarding proposed solutions at one time or another included all of the above alernatives in addition to suggesting the employment of new management staff. None of the recommendations satisfied the Board of

Trustees' insistent questions regarding cost containment, systems delivery timetables, cost/benefit analysis, staff expansion, and new systems implementation. Our District turned to facilities management because it provided us with proven computer system management skills, the human/technical short-term resources of a large corporation, a track record of strong user liaison, a fixed dollar cost, and the skill and ability to bring up complex, interactive, real time programs in a short period of time.

In our eighteen-month experience, we have put up a new transactional payroll/personnel system; we are currently in the midst of registering our 94,000 students as a part of a comprehensive student system; we are in the last thirty days of installing a new financial accounting system, and at the same time, we have doubled our enrollment in computer science instruction and made significant increases in computer assisted and managed instruction, as well as faculty use of the computer for a variety of purposes. We have increased our routine production by 61% with the same number of staff personnel while we installed three major new systems. Obviously, I am pleased with our success, but there are negative aspects of facilities management. The computer operation does cost more than it did before, if you measure only by dollars appropriated. The staff works for SCT not for our college. If we were to decide to go back to an internal operation, the shift could present difficulties.

Finally, we find ourselves the victims, or the benefactor, of visitors not only from the United States but elsewhere in the world to see how we turned a loser into a winner. On balance, we in San Diego think we have a real computer bargain.

Any of the above items could be dealt with in a variety of combinations. Elected officials can get second opinions from consultants, competing vendors, and other institutions.

The key factors for an elected official to know are: what options exist; to determine institutional needs; to be satisfied with cost/benefit data and to control cost per output, not just total dollar expenditure.

In our student system alone, a recent study shows the potential of saving $330,000 annually in personnel costs by the computer doing work formerly done by employees.

Alert elected officials will insist on such reports and monitor the implementation of such savings.

Elected officials need not be computer experts, but by persistent raising of questions and a modest knowledge of alternatives, they can play the most important role in decision-making about computers.

TRACK III
THE EMERGING TECHNOLOGY

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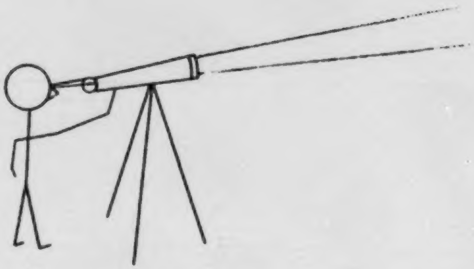
SENIOR MANAGEMENT VIEW OF DISTRIBUTED PROCESSING

by

Robert L. Patrick
Computer Specialist
Editorial Advisor
Datamation Magazine

SENIOR MANAGEMENT VIEW OF DISTRIBUTED PROCESSING



BOB PATRICK
NORTHRIDGE, CA

As many of you may know, we all face the same problems in computing whether we work in an industrial or a campus setting. The top five problems on my list are:

1 - Shortage of trained people

2 - Legacy of existing old programs which require careful maintenance and modification.

3 - Gap between what advertising says is available and what we are really able to do.

4 - Lack of accepted policy guidance concerning computing, planning, justification, and controls.

5 - Proliferation of computers, languages, and dialects which is going to get worse before it gets better.

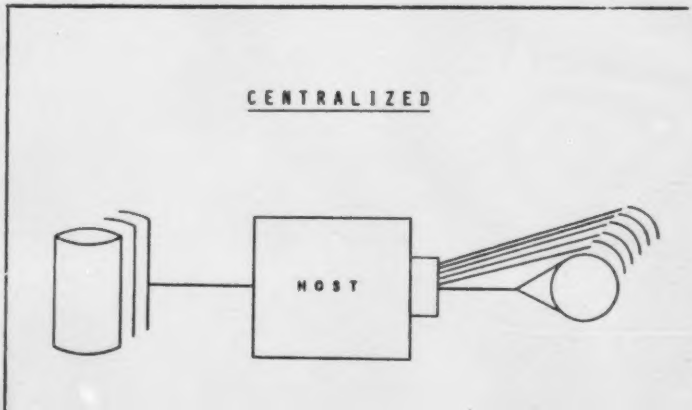
My talk today will be about "control and proliferation." Now I realize that control and academic freedom are mortal enemies, but hear me out as I think some compromise is in order.

Proliferation is to computing what mono is to fraternity/sorority life. It's going to happen, there is no innoculation against it, it takes a long time to get over it, and sometimes you feel weak for years.

I was working on a campus a couple of years ago and they had 26 computer installations. One was the main administration center, one was the main academic center, and there were 24 others ranging in size from a stand-alone Apple to a rather deluxe $2M complex driving tutor terminals. In the 26 installations they had 15 different CPUs and innumerable other manufacturers of I/O devices and components. They could easily have had 45 vendors and 40 different language dialects. That's proliferation!

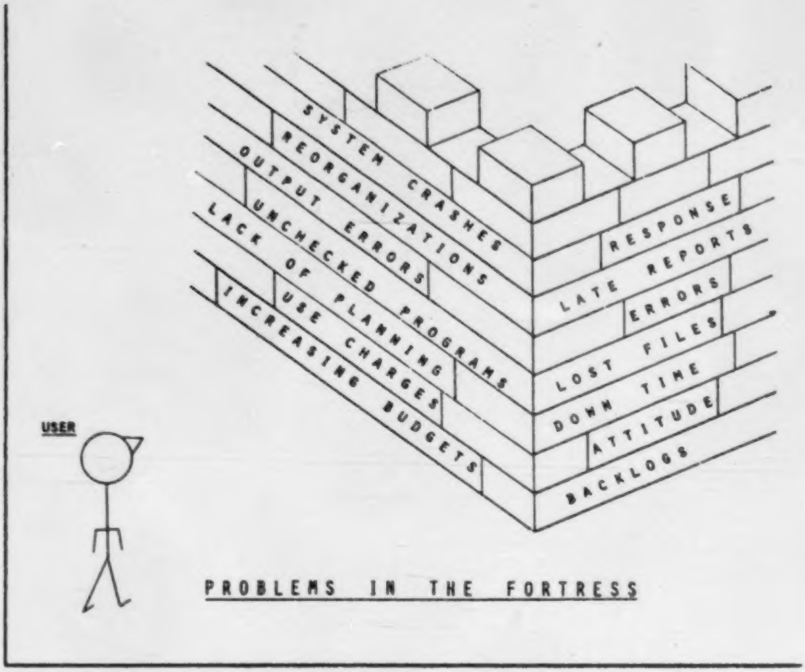
Problems with Centralized Processing

We all know what a centralized shop looks like. Centralized equipment, data, programming, management, priorities, and budget. Access is batch and on-line. The goal is efficiency and economy, but the center looks different to its users.



Users generally know more about what they don't like than what should be done. They know:

1 - Backlogs
2 - Changing faces and vacations
3 - Elitist attitudes
4 - Programmers without subject knowledge
5 - Late reports
6 - System unavailability
7 - Slow response
8 - Rebuilding files after a crash
9 - Increasing budgets
10 - Use charges (equitable and otherwise)
11 - Reorganizations
12 - Unchecked out programs
13 - Output errors
14 - Planning for EDP

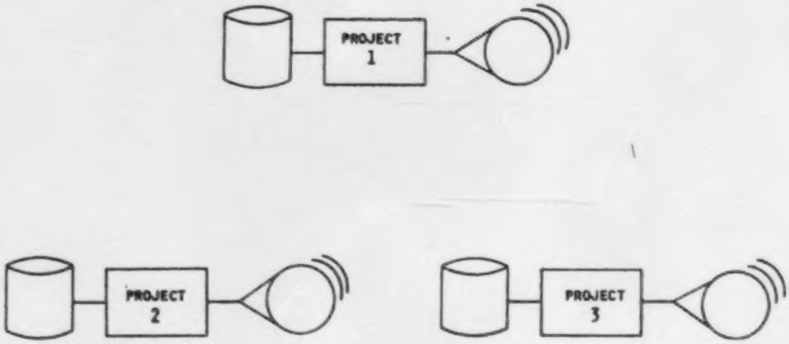

USER
SYSTEM CRASHES
REORGANIZATIONS
OUTPUT ERRORS
UNCHECKED PROGRAMS
LACK OF PLANNING
USE CHARGES
INCREASING BUDGETS
RESPONSE
LATE REPORTS
ERRORS
LOST FILES
DOWN TIME
ATTITUDE
BACKLOGS

PROBLEMS IN THE FORTRESS

Before proceeding, What is Distributed Processing?

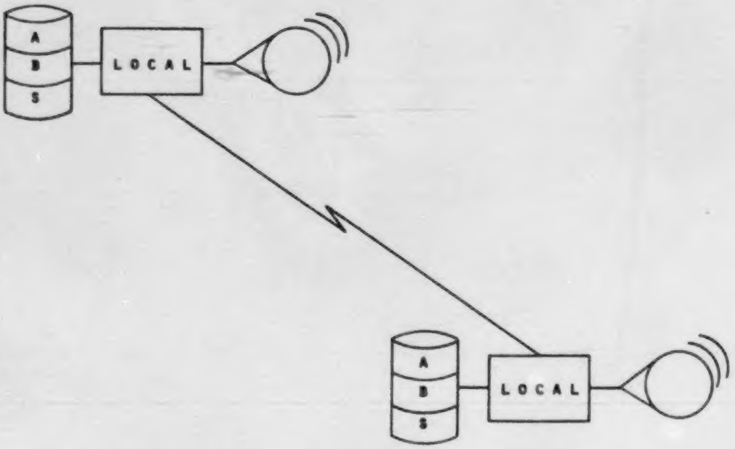
First, let's discuss the stand-alone distributed system as being simpler managerially, and a lot of trouble organizationally. In this class lie the personal Apples, the laboratory support equipment, and the project specific computer which was brought on-campus as part of some contract and is supposed to disappear at the end of the contract period.

STAND ALONE


PROJECT 1
PROJECT 2
PROJECT 3

Second, we have computers that must communicate with one another for processing or to share data. These could be used for administrative purposes, in the library, or in a small network providing a multiplicity of student services all over the campus. They come in several varieties.

FULL DUPLICATION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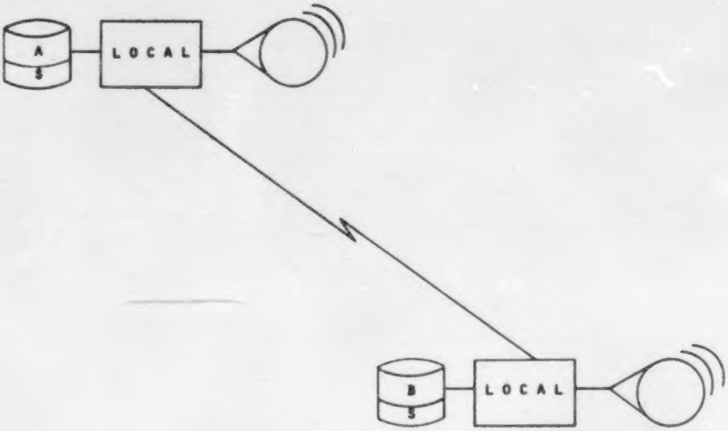
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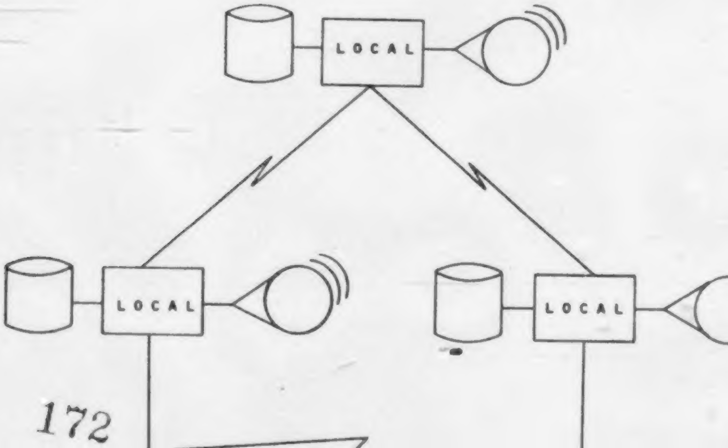
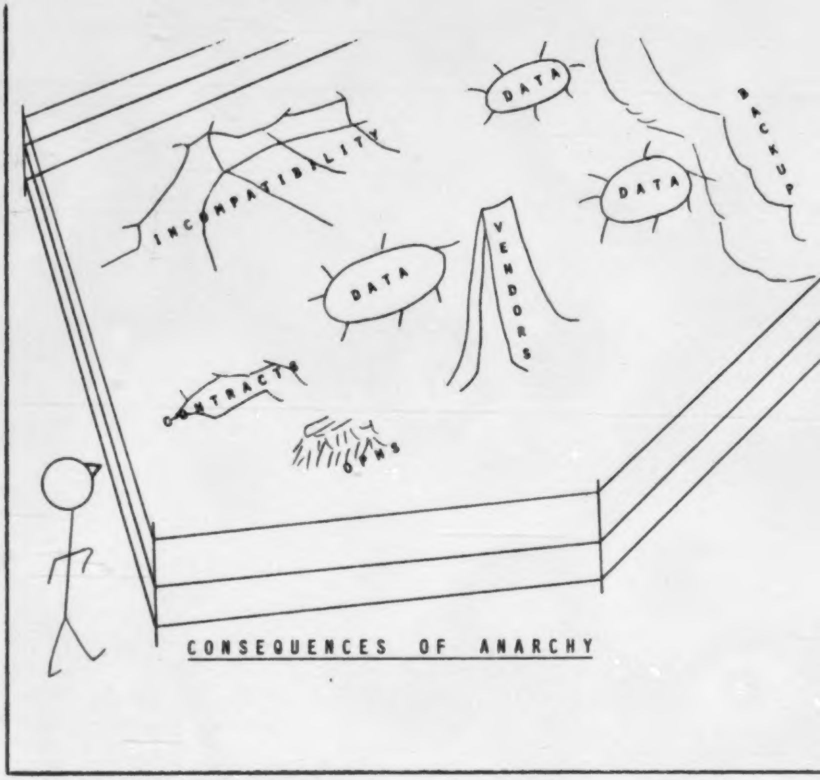

LOCAL
LOCAL
LOCAL

Problems with Distributed Processing

If you distributed without controls, you get

1 - Incompatible equipment
2 - Poor vendor contracts
3 - Unresponsive vendors
4 - Inept programming
5 - Bad data throughout the system
6 - Inadequate attention to backup and catastrophe precautions
7 - Uncertain operation
8 - Shortage of documentation, logs and records for troubleshooting
9 - Risk of general breakdown in the function being served
10 - Great deal of unpleasantness when the blame is assessed
11 - A rescue operation which impacts computing throughout the campus
12 - Some damaged reputations, primarily in the central organization
13 - A setback for automation on your campus.



Some of the Troubles I've Seen

Many of these have direct campus parallels:

1 - Large insurance company, claims status application, central development - first application used excessive resources, not discovered until second application gave performance problems that impacted both.

2 - Big areospace company, diverse scientific applications, independent developments - controlled by vendors, multiple systems for same purpose, government displeased.

3 - University library, bibliographic retrieval application, development managed by amateurs - unsupervised programmers chose to develop software and ignore application, money used up, job not done.

4 - Big aerospace company, distributed data capture application, central development - experienced team, multiple installations, first one fine, the more installations the more they all suffered (performance, availability, support).

5 - Big government laboratory procured custom systems individually from lowest bidder. Now has one of everything, all bought at retail and faces the following:
   a) Severe maintenance problems.
   b) An excessive support staff.
   c) Creeping inflation in fixed costs.
   d) Accelerating crises when key people get promoted or leave.

What Does All This Mean?

1 - Distributed is different.

2 - Policy and limited controls must be established.

3 - Training and education required even though team is heavily experienced in batch applications.

4 - Full customer responsibility is equivalent to abdication by central team.

Some Rules for Living

Make firm distinction: contract funded, GFE, ship when research is completed versus administration, joint use, buy for a dollar and keep around. These rules apply to the latter; and cover both minis, midis, and word processing stations.

Prohibition and bureaucratic reviews don't work. So try this proposal:

Policy - Technical committee to define general requirements, hold competition, and negotiate master contract with chosen vendor(s) every four or five years. Equipment bought under this contract should be cheaper, quicke delivery, enjoy on-campus support from other users. Central site will maintain software and provide consulting assistance.

Multiple CPU Vendors will be discouraged, but not prohibited. Plug compatible I/O will be scrutinized to be sure that blessings are positive. (Pric delivery, installation, reliability, service, software, externally developed libraries.)

Staffing - Clearinghouse for trained staff will be maintained. If you are big enough, do central recruiting and training. Talent will be your bigge problem. Talent at the end of the system's life cycle will be most difficult.

Standards are the way to stretch what talent is available, insure against disaster, and support an old system in the waning days of its life cycle. (Operating system, application language, documentation, operational management, and service reporting.)

Quality Reviews - Forget quality reviews for all jobs with a short half-life, the fight is not worth the effort. However, for long-lived jobs insist on reviews during development and view under-documentation with alarm. (Development methodology and Fagen's inspections.)

Distributed Responsibility

In industry distributed responsibility covers:
- Budget
- Staffing
- Security
- Work flow
- Control of programmer privileges
- Protection of files

and is accomplished by proper attitude and motivation.

On campus problems are more severe since you must contend with

- Turnover among student labor.
- Conflicting interests among
  - Administration
  - Departmental staff
  - Principal investigators
  - Student assistants.
- Power politics.
- Tenure.
- Elitist attitudes.

How To Get Well If You Are Sick

Campus-wide policies:
1 - Commonality and bulk discounts.
2 - Central software support.
3 - Central maintenance and spares.
4 - Newsletters for information exchange.
5 - Restrict development on orphan equipment.
6 - Migrate non-standard equipment to dedicated uses or surplus it off-campus.
7 - Minimal recordkeeping for vendor qualification.
8 - Computer corner in the library and vendor seminars to ease the chore of keeping up.
9 - Central HELP group to assist in acquisition and installation.

Summary

1 - Initially it appeared that distributed computing was the answer to a maiden's prayer since the jurisdictional disputes and the priority distribution arguments over scarce resources was soon to end.

2 - Now we know that full competitive procurements for quantities of one cause vendors to steadfastly bid list price and no discounts.

3 - We also know that a unique configuration at each site, with unique software, and a sprinkling of locally built hardware and locally modified software is the formula for maximum cost, maximum unhappiness (in the long run) and nobody to blame it on.

4 - If this takes place in an environment with high turnover and little documentation, you may have to explain why you can't do this quarter what you did easily last quarter.

5 - You may even find the vendors take advantage of your disorganization with slow response to trouble calls, a shortage of parts, list prices, and long delivery schedules. (You might check and see whether the same maintenance person reappears on subsequent service calls.)

6 - If you are doing it all wrong, you may even see your fixed budgets slowly increasing as your installed computer base grows and with it your service and support commitments.

7 - You may even find that you can't undertake the new applications you can afford because all the available talent is busy keeping the old stuff running.

8 - You may find that schedules for new applications are just as unsure on mini-computers as they were on maxi-computers only it may cost more since new minis are not usually shared.

9 - While you're looking, see if you are paying for your applications twice: once on the central facility to run production, and again on the new mini which is almost ready to take over the production, but not quite.

10 - Or you may find some course work on the "free" mini-computer that was installed for some contract, but now that the contract is over that computer has entered your fixed support budget since the academic work has locked you in.

* *

If you have just a few of these problems, you probably need a joint work party (not a committee) to draft some policy. These problems tend to multiply and resolute administrative action is required to affect a recovery.

AUTOMATIC SPEECH RECOGNITION

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ABSTRACT: While work in Automatic Speech Recognition (ASR) goes back to the mid 1950's, it has just been since 1970 that practical ASR, limited to discrete utterance, or isolated word recognition, has really seemed possible. The technical community became seriously interested in automatic recognition of continuous speech in the early 1970's. Since that time, considerable advances have been made in the methodologies and implementations of ASR.

This presentation describes an experimental approach to continuous speech recognition being carried out at IBM Research. It is based on statistical methods that allow automatic extraction of recognizer parameter values from speech data. Research results are presented for both artificial and natural recognition tasks.

Also, a speech terminal system will be described which performs discrete utterance recognition, audio response, and speaker verification.

INTRODUCTION

In the relatively recent past, workers from a number of disciplines have merged into a field called speech processing. These disciplines include mathematics, physics, psychology, linguistics, engineering, artificial intelligence, computer sciences, and the speech and hearing sciences.

It has been an aspiration of these scientists and technologists to devise machines which respond in appropriate ways to spoken input. These responses could include translation of speech into pointed words -- the "voice-driven typewriter" -- a task which is now called *recognition*, and/or machine actions, e.g., retrieving specific data from data bases, mechanical movement, *et cetera* -- the speech *understanding* task.

In the 1950's, reports on automatic speech recognition (ASR) work started appearing in technical publications. Since that time, a considerable body of literature has built up around one kind of ASR, involving recognition of *isolated words/phrases*. This work, commonly referred to as *discrete word* or *utterance recognition*, has developed sufficiently to allow its commercializing by a number of firms. Recently, some of the techniques developed for isolated-word recognition have been extended to connected strings of essentially context-independent words -- digits, for example; this is being referred to as *connected word recognition*. Another, less well-understood form of speech recognition/understanding involves *continuously-produced speech*, where the system must not only deal with signal representation and pattern recognition, but also language processing.

From an historical point of view, automatic speech recognition has attracted and repelled segments of the scientific and technical community in cyclic fashion since before the emergence of modern electronics. The periodicity of the onsets of interest has been somewhat linked to palpable innovations in the primary disciplines of the workers involved and surges in the availability of financial support.

A number of techniques have been developed for automatic recognition of isolated, single-word-length utterances. In fact, the vast majority of recognition work prior to 1972 was at the presegmented level. Since that time, there has been widespread interest in the continuous-speech problem. Operationally defined, discrete utterance recognition (DUR) is the process of recognizing (or 'understanding') any utterance in which the following assumptions are made:

- The whole utterance exists as a predefined, known pattern of whatever constituency.
- It is not generally necessary to make internal decisions relative to within-pattern syntactic boundaries or prosodics.

- It is not necessary to account for variation among occurrences of a 'pattern' other than those of duration and/or over-all energy.
- There is a known, finite number of patterns to be recognized, each having been used to 'train' the recognizer, i.e., each is a unique unit in the experimental vocabulary of the system.

On the other hand, true continuous-speech recognition permits very few assumptions concerning input, other than those the average listener might make in the natural process. In practice, most continuous-speech recognition work involves, as a necessary convenience, a set of constraints on input data. These usually relate to:

- the 'normalcy', age, sex, and/or identity of the talker,
- the environmental conditions -- ambient environment -- in which the user is speaking,
- the syntax and lexicon of 'admissible' utterances, and/or
- the number of different lexical entities.

It must be pointed out that, *ceteris paribus*, continuous-speech recognition is much more difficult than 'understanding'. In recognition, tolerance for error is minimal; a printout of "Eye want shoe two stop sending bills.' would not be acceptable to a reader, but if the system correctly decoded four key words, it could interpret ('understand') the command perfectly. Thus, in understanding, the only errors made by the system are those which result in the wrong action being taken. For recognition purposes, there are three word-level errors in the above utterance, so accuracy would be zero at the sentence level and only 77.5% at the word level. For understanding, accuracy would be 100%, if all the system needed was '...want...stop sending bills.' Obviously, the understanding process would be very sensitive to small word-level errors where a minimal phonetic difference shifts 'meaning.' Such a case might be 'Move the eight blocks sideways.' versus 'Move the eighth block sideways.' It is, at present, always necessary to construct a 'command language' to be used by such a system so that minimally-different commands do not coexist at the same level.

Another form of speech recognition -- usually referred to as 'word spotting' -- can be employed to advantage in the recognition process. In this, a passage of continuous speech is scanned in an attempt to detect a particular pattern sequence corresponding to a fairly stable 'content' word. Generally, such methods use long and/or stressed words, so as to minimize error. Usually, some technique is employed to 'normalize' the utterance to be spotted with regard to duration and/or over-all energy. These techniques yield good results, so long as care is taken to minimize the occurrence of similar image sequences across word boundaries; for example, find 'recognize speech' in 'That machine can really wreck a nice beach.' One of the most debilitating aspects of continuous speech for word spotting, and recognition, for that matter, is the phenomenon of homophony -- or 'sound alikes.' In DUR, one must only avoid sets of words like two-too-to, pare-pair-pear, ate-eight, et cetera, but in continuous speech, homophony becomes very complex, involving word sequences as well as single words.

Evaluating a particular system's performance, in terms of its predefined goals, presents no difficulty at all. One simply measures, at the processing level of interest, the degree to which the system does what it was designed to do. Ultimately, of course, performance must be measured at the level where the system provides a service to the user. If the aim is a speech-driven typewriter, the system can be evaluated at the word and sentence levels (and perhaps as a punctuator). However, many problems arise when an attempt is made to compare one system with another in ways which are mutually agreeable to the respective owners. While a number of attempts have been made to provide bases upon which systems can be evaluated, no real success has been achieved here. The main problem involves the determination of the relative difficulty of the tasks for which different systems have been designed. Unfortunately, extant systems are so extremely difficult to adapt to new, perhaps completely different tasks, that running comparative studies on the same task has not been done. In the absence of a common task, little agreed-upon success has been achieved in attempts to establish measures which relate different tasks in terms of difficulty.

STATISTICAL METHODS IN AUTOMATIC RECOGNITION OF CONTINUOUS SPEECH*

At IBM Research we are now working on the recognition of continuous natural speech, without the aid of artificial pauses between words, or unnaturally small vocabularies or artificial constraints on syntax. The particular utterances to be recognized are chosen from the *Laser Patent Text,* consisting of patent disclosures involving laser devices. Previously we succeeded in recognizing perfectly sentences generated by an artificial grammar known as New Raleigh.[1]

The distinctive feature of our approach is that it formulates the recognition problem in terms of *communication theory.* As a consequence, we base our system on careful statistical modeling of all speech processes involved: sentence production, speaker's pronunciation, and the recognizer's speech signal processing.[2,3]

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*This section of the paper was written by Dr. Frederick Jelinek, who is the manager of the Continuous Speech Recognition Group at IBM Research.

Our models are derived from as much actual speech data as we can obtain and handle computationally. We have devised methods of automatic model computation, thus minimizing or completely eliminating human intervention. Our strategies are not based on rules developed from trying to intuit how people recognize sentences (as is prevalent elsewhere), although the basic structure of our models is, of course, man-made. This approach is both more accurate and more flexible; as the speaker or the components of the system change, our self-organizing programs remain valid, and computer time is all that is required to adjust to a new configuration.

All our experiments have been carried out with a system implemented on a general-purpose IBM 370/168 and tuned automatically to a designated speaker who was recorded (with one exception) in a quiet room with high-fidelity equipment.

The typical recognition experiment employs a speech recognizer consisting of an acoustic processor (AP) followed by a linguistic decoder (LD). Traditionally, the AP has been viewed as an artificial phonetician which attempts to transcribe the spoken waveform into a string of phonetic symbols. The LD then translates that string into written form.

At IBM we formulate the recognition process as a *communication* problem in which the speaker and the AP are conceptually viewed as combined in an *acoustic channel* which provides the LD with information y from which the LD can deduce the channel's input word sequence **w**. Actually, the LD tries to find that word string **w** which maximizes the probability $P(\mathbf{w},y)$ of the joint observation of the input-output pair $\mathbf{w},y$ at the terminals of the channel. As is well known, $P(\mathbf{w},y)$ can be rewritten as

$$P(\mathbf{w},y) = P(\mathbf{w})\, P(y \mid \mathbf{w})$$

Here $P(\mathbf{w})$ denotes the probability that **w** was generated by the sentence generator, and $P(y \mid \mathbf{w})$ the probability that as a result of the speaker's reading **w** the AP put out the string y.

In order for the LD to carry out its search, it thus needs statistical models of text generation and of acoustic channel performance to supply the probabilities $P(\mathbf{w})$ and $P(y \mid \mathbf{w})$. I shall discuss these models in the next section.

Because we have found it more fruitful to view the AP as a data compressor than as an artificial phonetician, we do not attempt to identify phonetic segments in the continuous speech. Our AP consists of a signal processor followed by a pattern recognizer. The signal processor first digitizes the speech at a 20 KHz sampling rate. Then every centisecond a discrete Fourier transform (DFT) is computed from a 2-centisecond segment of the sampled waveform. In this way an 80-component vector, called a spectral time sample (STS), is produced. Each component is the average magnitude of the DFT over some frequency band.

The pattern recognizer has stored in it a set of 200 prototype vectors of the same dimensionality as the STS. As an STS is generated, the pattern recognizer measures its similarity to each of its prototypes and puts out the identifier y of the most similar one. Thus the AP output y is a string of prototype identifiers, one for each centisecond of speech.

The prototypes correspond to various phones of English. They are selected automatically from a relatively large sample of the speaker's speech and are thus tailored exclusively to him.

The LD requires models of text generation (the language model, LM) and of acoustic channel performance. If the text is generated by an artificial grammar, then the latter serves as the LM.

In the future the design of a LM for a naturally generated text will probably involve considerations of syntax, semantics, and discourse pragmatics. So far no one has accomplished this. At present, the LM for our natural Laser Patent Text computes the probability of a word string $\mathbf{w}$ from the local probabilities $P(w_i \mid w_{i-1}, w_{i-2})$ that any word w_i of $\mathbf{w}$ will follow its two preceding words w_{i-1}, w_{i-2}. The local probabilities are estimated from a large amount of Laser Text set aside for this purpose.

The acoustic channel performance model giving the probability $P(\mathbf{y} \mid \mathbf{w})$ is also based on the Markov source concept. Our approach is to model the channel performance for all the words in the vocabulary and then obtain the model for the word string $\mathbf{w}$ by connecting together all the models of its individual words.

To obtain a performance model for any given word we first construct a phonetic source whose possible output strings are the transcriptions of all the different phonetic pronunciations of the word. Next, we replace every transition in the phonetic source by another type of Markov source -- an AP performance source corresponding to the phonetic symbol associated with that transition.

Space limitations prevent giving any details about AP performance sources beyond stating that they all have the same transition structure, and that a different source generating substrings y of AP output symbols exists for each phonetic symbol.

In attempting to find that word string $\mathbf{w}$ which maximizes the probability product $P(\mathbf{w})\ P(\mathbf{y} \mid \mathbf{w})$, the LD finds that sentence which best fits the observed AP output y, taking into account the likelihood of uttering the sentences in the first place. As there are obviously too many possible sentences for an exhaustive search, we use a search strategy that only looks at the most promising word sequences. At any given moment there is a stack which contains as entries all of the word sequences (partial sentences) examined so far. The stack is ordered according to the LD's estimate of the likelihood (relative to the observed AP string y) that the entry in question is the beginning of the actual sentence spoken. The likelihood of all of the sequences resulting from one-word extensions of the sequence on top of the stack is estimated, and the new sequences are reinserted into the stack so as to preserve its order. The search ends when a complete sentence is found at the top of the stack.

We have tested the IBM approach on both artificial and natural tasks.[1,4,5] In an experimental setting we have achieved perfect recognition in the first, New Raleigh language case. However, as of now, we can correctly identify only 91% of the words uttered in the Natural Laser Patent Text experiment.[5]

The vocabulary size of Raleigh is 250 while that of Laser is 1000. But vocabulary size is a poor measure of recognition task complexity. Perfect recognition could be achieved trivially for a language consisting of a single 1000-word-sentence. The difficulty of a task can be estimated from its entropy H, because Information Theory shows that a recognizer can ignore all but the 2^{nH} most probable word strings of length n (for large n) and yet achieve any prescribed recognition error tolerance. The entropy of the New Raleigh task is 2.86* while that of Laser is 4.6**.

Actually, natural tasks are more difficult than artificial ones for reasons beyond their larger entropy. Observe in Figure 2 that only very small parts of the vocabulary can be used at any given point of a Raleigh sentence, while a beginning of a Laser sentence can branch in many ways (see conclusion of the proceeding section). Also, natural sentences are usually much longer than those of the artificial tasks, thus increasing the chance that unrecoverable errors will take place.

THE SPEECH TERMINAL

Another project at IBM Research has addressed the problem of demonstrating the feasibility of a multifunction, stand-alone speech processing system in which a single set of programmable processors can perform discrete utterance recognition (DUR), audio response, and speaker verification. This discussion will only be concerned with the recognition task and an overall description of the speech terminal system.

DUR consists of steps in which (1) the signal is captured and converted to a form for later processing, (2) features are abstracted from the utterance and the resultant "feature-image" is either (3) stored for later use as a reference pattern (training) or (4) input to a pattern matching procedure (recognition); finally, (5) a decision rule is applied to the matcher's outputs and the "best" of the referent/input matches is selected -- the utterance is "recognized." In the speech terminal system, (1) consists of a close-talking, highly-directional, head-mounted microphone's output being converted to PCM by sampling the analog signal at a 10 kHz rate, quantizing each sample to a 12-bit representation (a data rate of 120 kbit/s). In (2), the PCM data are passed through five symmetric, 116-element, FIR bandpass filters whose outputs are accumulated over 15-ms intervals. The analysis bands are 100-500, 500-1000, 1000-2000, 2000-2500, and 2500-4500 Hz. Since the filterbank was designed to be flat, a signal amplitude function is computed from the sum of the filter outputs. Samples are overlapped in order to avoid F_0 (vocal pitch) interaction. Thus, for each 15-ms interval, the data consists of a six-element vector, each element quantized to one byte (0.25 dB/level). Also in (2), automatic procedures are employed to accurately detect the beginning and ending of each utterance. These procedures involve thresholding of amplitude and duration. Also, frequency-specific information is employed as a secondary check on utterance end. In (3) the primary problem consists of two parts, temporal registration (time-alignment) and estimating "similarity". For the first of these, dynamic programming (DP) procedures are employed. The purpose of DP is to achieve controlled, nonlinear, temporal registration between two utterances. DP methods differ in the approach taken in constraining the nonlinear warping. The method chosen as standard here is essentially that described by Itakura.[6] In DPR an utterance element can be repeated once (stretching time) or skipped (compressing time). In addition to these local constraints, the beginning and the end of the utterance are tightly constrained (forced match). The local and endpoint constraints, therefore, can be used to calculate, in advance, the maximum region of allowable match between two utterances. This results in a rhomboidal calculation geometry having slopes of one-half and two. For the second part of (3), a distance metric is employed which accounts for unimportant overall amplitude differences[7]. In (5), the overall distances between an input and the reference utterances are normalized for duration and the "nearest" referent is selected.

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*This is relatively high as artificial tasks go. The entropy of the CMU AIX-05 language on which the Carnegie-Mellon recognizer Harpy runs is 2.18.

** In a famous experiment, Shannon has estimated the entropy of unconstrained English to be about 5.5.

The entire process of recognition takes less than 10 ms. per vocabulary item, so that recognition response time is about .5 sec. for a fifty-word vocabulary.

The experiments which have been conducted with the speech terminal have shown its performance to be state-of-the-art.[8]

SUMMARY

Recognition/understanding of speech by machine has been seriously pursued by the scientific/technical community for about twenty-five years.[9] While a base of capability has been sufficiently established to allow commercialization of some limited forms of automatic speech recognition, there remain many problems to be solved before automatic transcription of unconstrained continuous speech can be done.

IBM Research is engaged in work directed toward the solution of these problems via methodologies based in communication - theoretic, statistical modeling and decoding.

REFERENCES

[1] L.R. Bahl, R. Bakis, P.S. Cohen, A.G. Cole, F. Jelinek, B.L. Lewis, and R.L. Mercer, "Recognition Results with Several Experimental Acoustic Processors," *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, IEEE Catalog No. 79CH1379-7 ASSP, pp. 249-251, Washington, D.C., April 1979.

[2] F. Jelinek, L.R. Bahl, and R.L. Mercer, "Design of a Linguistic Statistical Decoder for the Recognition of Continuous Speech," *IEEE Trans. on Information Theory*, Vol. IT-21, No. 3, pp. 250-256, May 1975.

[3] F.Jelinek, "Continuous Speech Recognition by Statistical Methods," Proceedings of the IEEE, Vol. 64, No. 4, pp. 532-556, April 1976.

[4] L.R. Bahl, J.K. Baker, P.S. Cohen, F. Jelinek, B.L. Lewis, and R.L. Mercer, "Recognition of a Continuously Read Natural Corpus," *Proceedings of the IEEE International Conference on Acoustics, Speech, and Signal Processing*, IEEE Catalog No. 78CH1285-6 ASSP, pp. 422-424, Tulsa, April 1978.

[5] L.R. Bahl, J.K. Baker, P.S. Cohen, F. Jelinek, B.L. Lewis, and R.L. Mercer, "Further results on the Recognition of a Continuously Read Natural Corpus", Denver, Colorado, April 1980.

[6] F. Itakura, "Minimum Prediction Residual Principle Applied to Speech Recognition, *IEEE Trans. on Acoustics, Speech and Signal Processing*, Vol. ASSP-23, pp. 67-72, Feb. 1975.

[7] H.F. Silverman and N.R. Dixon, "A Comparison of Several Speech- Spectra Classification Methods", *IEEE Transactions on Acoustics, Speech and Signal Processing*, Vol. ASSP-24, No. 4, pp. 289-295, Aug. 1976.

[8] H.F. Silverman and N.R. Dixon, "State Constrained Dynamic Programming (SCDP) for Discrete Utterance Recognition", RC 8061, IBM T.J. Watson Research Center, January 1980.

[9] Dixon, N.R. and Martin , T.B. (Eds) *Automatic Speech and Speaker Recognition*. New York: John Wiley & Sons, Inc., 1978.

OFFICE AUTOMATION PILOT: A Paperless Approach

at

College of DuPage
Glen Ellyn, Illinois

by

Bart Carlson

Abstract

A progress report on the development and implementation of a two year Office Automation Pilot: A Paperless Approach.

This pilot includes the installation of a WANG OIS 140 mini-computer connected to a host IBM 4341 computer in IBM 3271 "look-a-like" controller mode. It encompasses word processing, electronic document filing and retrieval at the host, data processing (all current 3270 applications using CICS), electronic mail (local and national) and electronic calendars.

Any of the seven administrators or four management support staff in the Office Automation Pilot can create, send, receive, forward or file mail from their CRT workstations located at each of their desks. Mail will also be directed electronically via the IBM 4341 host connection to the GTE TELENET Telemail Network using X25 protocol. With these facilities a participant can send a one page letter anywhere in the country and have it delivered in just a few seconds at an approximate delivery cost of fifteen cents.

The project is being funded entirely as a result of productivity increases on a two year full payback basis for all equipment, software, and remodeling expenses. The elimination of three full time clerical positions is the primary source of these savings.

OFFICE AUTOMATION PILOT: A Paperless Approach

INTRODUCTION

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College of DuPage

College of DuPage is a comprehensive community college established in 1966 in ten high school districts west of Chicago, Illinois. Since 1967, student enrollment has grown from fewer than 3,000 students to more than 26,000 students. The College offers a variety of programs that include the first two years of baccalaureate education, career education, general studies, community education, and public service activities.

The main campus is located in Glen Ellyn, Illinois; however, classes are also held in over 50 locations throughout the county to provide greater accessibility to the College for district residents.

Computer Services

Computing at College of DuPage began with an IBM 360/30 maxi-computer in a trailer in 1967 and progressed to a position of leadership in higher education terminal based administrative systems in the late 70's. Much of the development of on-line systems was sparked by a grant to develop an interactive terminal based counseling program (CVIS - Counseling and Vocational Information System). This terminal communication system was the base from which the registration, financial accounting, library, and other administrative systems were developed.

During the 1970's the institution continued to expand as did demands on the CVIS system until, in 1978, the administration recognized the need for a long range computer services master plan for College of DuPage.

Long Range Computer Services Master Plan

In the spring of 1979, Computer Services staff developed a formal long range plan for review by the Computer Services Management Committee. This plan started with the mission, philosophy, goals and history of both College of DuPage and Computer Services, and a discussion of computing industry trends. The plan included detailed sections on functional requirements for both academic computing and administrative systems, a technical plan for computing hardware and software (showing several alternatives), and a financial plan.

Of particular interest is the section on industry trends relating to hardware, software, and staffing. These sections conclude that, for College of DuPage, the best course of action was to invest in commercially developed and maintained software rather than in a larger staff. As a result of this conclusion, the Computer Services Department has a very competent but small full time staff of seventeen people.

The long range plan was approved in June 1979 by the Computer Services Management Committee and the Board of Trustees. Implementation of the plan began almost immediately.

Computer Hardware and Software

The current hardware at College of DuPage includes an IBM 4341 maxi-computer for administrative systems and some academic computing, a Hewlett-Packard 3000 mini-computer for academic computing, and a DEC 11/34 mini-computer for the CLSI library system. Computer Services also operates an NCS-7008 mini-computer based optical mark reader.

In addition to local hardware, College of DuPage also uses the PLATO System at the University of Illinois, the EDUNET Network, the OCLC Library Network, the MDSI Network, and the GTE TELENET Telemail Network.

Recognizing the increased role of micro-computers in education, College of DuPage has recently acquired over fifty Radio Shack TRS-80's, Apple II's, Commodore Pets, and a Texas Instruments 99/4 among others.

Many of these fifty plus micro-computers and over one hundred terminals are connected to the mini-computers and maxi-computers described above. Many are hard wired but some have dial-up capabilities.

Of particular interest is the use of numerous Lear-Sieglar ADM 3A CRT terminals which can dial-up all of the systems described above. In addition to being just an asynchronous terminal, they can access the IBM 4341 maxi-computer in an "IBM 3270 mode" via a protocol converter box located at the central computer site. It allows use of all the hundreds of programs which were written to support the IBM 3270 terminals only.

Along with the equipment described above the College has acquired approximately one half million dollars worth of commercially prepared software packages since the adoption of the long range plan. These packages range from administrative systems such as the CICS Mailing Information System (MAIL) from Software Module Marketing, the IAI On-Line Student Records System, and the CLSI library system among many others. It also includes academic systems like a nuclear power plant simulator, a reaction kinetics system, a music composer, and a retail management system among numerous others.

Management Model

Another interesting aspect at College of DuPage is the management model which has been developed to manage and advise Computer Services.

Computer Services is managed by the Computer Services Management Committee (CSMC). Membership on the CSMC consists of the president, the two provosts and the three vice presidents. The CSMC, which has direct line responsibility for Computer Services as well as all other functions in the institution simply by their collective individual positions within the institution, meets on the third Wednesday of each month at 9:00 AM.

Two other advisory committees are also included in this management model. The Administrative Systems Users Advisory Committee, which also meets monthly, consists of a mixture of key area administrators. As its name implies it focuses on the computer resources which primarily support administrative functions.

A third committee focuses primarily on academic users of computing and is called the Academic Computing Users Advisory Committee.

Memorandum of Opinion

In the fall of 1978 it was realized that the academic and administrative departments were buying computer related equipment and software items without any overall plan or coordination. This practice was being encouraged in large by the technological advances being made in the industry where prices were falling to new all-time low levels. Because of this, a department could acquire a terminal, micro-computer, or mini-computer for only a few hundred to a few thousand dollars.

As the process of developing a plan progressed, it became clear that an eight year plan could not be developed which would encompass every possible future use of micro- and mini-processor technology. This included security systems, typesetting machines, voice telephone systems, microcomputers, mini-computers, and text or word processing systems among many others.

Since individual departments were continuing to acquire computer related equipment and software as the long range plan was being developed, Computer Services became increasingly concerned that items being acquired now may not be compatible with the overall direction the institution would be choosing for the next decade. Immediately a search begain for an internal mechanism or procedure which would solve both problems, e.g., individual departments buying computer related items without overall coordination and the inability to spell out every item which computer technology might penetrate in the next eight years.

After considering a number of alternatives a decision was made to submit a formal recommendation to the Computer Services Management Committee for their review, consideration, and approval. The recommendation, entitled "Coordination of Instructional and Administrative Computer Related Equipment and Software Acquisitions," is listed below in its entirety.

> RECOMMENDATION
> CSMC hereby creates the administrative policy requiring that all computer related equipment and software acquisitions be formally reviewed in writing via a "memorandum of opinion" by Computer Services prior to acquisition and that said policy be monitored and enforced by the C/D Purchasing Department. Final approval of said acquisitions will rest with the CSMC.

This policy recommendation was approved on December 20, 1978, and the College of DuPage has continued to operate under its guidance and direction since that time.

The results have been interesting to say the least. Many believe that it can be fairly stated that the response from individual departments has been very well received.

One area of benefit resulting from this policy has been an increased awareness on the part of the departments for planning. Several academic departments have developed long range plans for the first time. The Secretarial Science Department's plan called for a whole new curriculum, including a new department name--Office Technologies. Because of this increased focus on planning, the departments are finding it easier to get the resources they need to carry out their respective missions.

INTRODUCTION

A second area of benefit is the campus wide compatability for interconnection to the mini- and maxi-computers on campus, as well as the computing resources available through the national educational computer networks. Numerous spin-off benefits result from campus-wide compatibility, including ease in problem determination of a complex network and ease in coordinating hardware and software maintenance activities. Finally, the overall institutional planning seems to be enhanced because of the institutional awareness of "what's happening" at the department levels. This has even occurred for items often times not previously considered to be computer related.

However, as is often the case with any change of this magnitude, some "period of adjustment" and "tuning" in the process was necessary. Since the policy was implemented in mid-year, literally months after the individual departments had budgets "approved" at the highest level, it was a shock for some of them to find out they needed to go through a new level of review, justification, and approval. This, however, was felt to be only a start-up problem during the first year. For the second year, this review was tied in prior to budget "approval" at the highest level and therefore puts the "memorandum of opinion" process in the budget preparation cycle where it belongs.

One other issue of importance which was discussed at the time was whether or not an item price level, if any, should be included or excluded from the policy. It was decided to let the policy be all encompassing, and that if experience demonstrated that it needed to be refined, it could be modified at a later date. This might come under what some call the "do it now" philosophy. It is probably better to take some action now, using the knowledge available at the time, rather than spending years trying to define every possibility which might occur and never doing anything or doing something after it's too late.

OFFICE AUTOMATION PILOT

Scope and Objectives

"All executives have multifunctional terminals. Computer-based voice recognition allows draft documents to be output from spoken words. The words first appear on a terminal display for editing and revision by the author.

OFFICE AUTOMATION PILOT

The final draft is sent via electronic mail anywhere in the world, with a duplicate filed in a micrographic storage system. As a matter of course, no paper is used."

The above paragraph describes the office of the 1990's. "The paperless office" is the way of the near future! As a public educational institution, C/D felt it had an obligation and a commitment to it's community and students to provide the best educational system possible within budgetary constraints. Staying within the budgetary constraints has posed a challenge, considering the ever increasing burden of administrative support costs.

In an effort to increase the efficiency and effectiveness of the clerical/administrative support operation, an Office Automation Pilot was proposed and subsequently approved in July 1980 by the Board of Trustees. It is based on the most advanced integrated data and word processing equipment and software available at the time.

In order to provide this experiment with both vertical and horizontal organizational relationships seven offices were selected to participate. They include: 1) Provost, Main Campus; 2) Executive Dean; 3) Dean of Students; 4) Dean, Business and Services; 5) Dean of Occupational Division; 6) Associate Dean, Technology; and 7) Associate Dean, Health and Public Services.

These administrators are served by a management support team consisting of: one Management Support Coordinator; one Management Support Specialist II, and two Management Support Specialist I's.

The objectives for the Office Automation Pilot are:

1. To increase the efficiency and productivity of the clerical/administrative support operation of the above mentioned seven offices.
2. To effect cost reductions as feasible and appropriate.
3. To develop a personnel classification system as it relates to the automated office, including career paths for the clerical/administrative staff related to the level of responsibility and duties assigned.
4. To determine the technical and non-technical aspects of implementing a comprehensive plan for

all C/D offices, e.g. training, maintenance, interface, psychological.

5. To develop a Long Range Office Automation Master Plan for C/D. This plan should be completed so implementation can begin in July 1982.

Administrators

Some relocation of administrative offices was required to implement the pilot. This included re-arranging offices to effectively utilize the management support team concept. It also encompassed remodeling two suites to accommodate these administrators. All the vacated offices were then converted to much needed conference rooms.

Each administrator has a video workstation at his/her desk and access to the administrative support team to handle necessary office functions.

Training is provided for all administrators involved in the pilot. This includes information entry and retrieval, dictation, organization of work, and procedures for efficient use of word processing equipment. Training has also been offered for office and text processing, data processing, and electronic mail, while training for electronic calendaring is planned for in the near future.

These training sessions are provided by one Secretarial Science faculty member and several Computer Services staff members.

Classified Staff

With the implementation of the Office Automation Pilot all pre-pilot secretarial staff were guaranteed employment without loss of salary at C/D.

The previous secretarial positions that existed in the offices referred to were abolished and four new positions were created. All seven secretaries were also given an exclusive opportunity to apply for the newly formed positions. Complete job descriptions and qualifications were published. An interview screening and selection model was employed which eliminated the respective administrators from being involved in the process for his/her secretary.

All seven desired to apply for the new positions and, in fact, four accepted positions. For those not involved Personnel Policy #4061 Assignment of Staff was followed as described below:

B. Classified Personnel

1. A classified employee whose position has been discontinued and whose work performance has been satisfactory shall be placed in a comparable position if available. If a comparable position is not available, the person shall be placed in a position for which the person is qualified at no reduction in range classification or step placement until such time as a comparable position is available or performance evaluation inducates otherwise.

    a. If a comparable position is available at a later date, the employee must be willing to accept such a position, otherwise his/her placement will be reduced to the position being held.

The four people selected to fill the new positions were trained in the following areas: word processing equipment operations, telephone demeanor, data entry and retrieval, dictation equipment operation, and efficient office procedures.

A Secretarial Science faculty member provided much of the above training since C/D currently is teaching a word processing concepts course and has defined two additional word processing courses. Computer Services staff are providing the other training components. In addition the Management Support Coordinator was sent to two WANG classes.

All the activities in the pilot are religously documented and a procedures manual is being developed to be used as a guide for future office conversions at College of DuPage.

Evaluation

During the pilot three evaluation and installation studies are being conducted as shown in the Implementation Schedule. Identical functional activity surveys and attitudinal surveys are being administered for all three studies. The results of these are being analyzed and summarized in a written report.

Hardware and Software

The following table lists the equipment needs for the first year (or base) as specified in the Secretarial Science 5-Year Plan and the additional equipment needed to support the Office Automation Pilot.

A change to the larger WANG Office Information System (OIS) 140 was required to handle the additional workstations and storage requirements of the Office Automation Pilot.

The WANG OIS 140 and its associated workstations are serving both as text or word processing terminals as well as data terminals. Three of the thirteen workstations have dial-up TTY capabilities for accessing on campus asynchronous computer ports as well as national computer networks. Plans also include attaching the WANG CIS 140 unit to the IBM 4341 computer as a "look a like" IBM 3271 controller in the near future.

When WANG delivers this software, it will be a major accomplishment because it protects the large investment College of DuPage already has made in data processing and provides for all functions to be performed at a single workstation. This is important because it will significantly reduce the equipment requirements of the future.

Hardware Description		Purchase Price	Annual Maintenance
Secretarial Program Base			
1 WANG OIS 125	=	23,845	2,500
2 WANG 5536-2 CRTS (1 w TTY)	=	8,084	480
1 WANG 6581-W Printer 40 CPS	=	5,640	420
Sub-Total	=	37,569	3,400
Office Automation Pilot			
1 WANG OIS 140 (additional amount over the base WANG OIS 125)	=	6,180	80
11 WANG 5536-2 CRTS (2 w TTY)	=	47,312	2,640
2 WANG 6581-W Printers (40 CPS)	=	11,280	840
Sub-Total	=	64,772	3,560
Total	=	102,341	6,960

OFFICE AUTOMATION PILOT: A Paperless Approach

TECHNICAL

The WANG OIS 140 workstations replaced several pieces of existing data processing equipment which was already being used in the offices participating in the pilot. These are being sold in the open market to the highest bidder using the following assumptions: 1) sell oldest units; and 2) sell fall 1980.

The equipment being replaced includes three IBM 3278 CRT's and two IBM 3287 printers.

Communications

```
--------Office Automation Pilot------- -Secretarial Science-
Suite 1             Suite 2

5 WANG CRTS(1 Dial) 6 WANG CRTS(1 Dial) 2 WANG CRTS(1 Dial)
1 WANG Printer      1 WANG Printer      1 WANG Printer
        .                   .                   .
        .........................................
                            .
                 ......................
                 .    WANG OIS 140    .
                 ......................
                            .
                  ....................
                  .WANG COMMUNICATION.
                  ....................
                            .
                      .............
                      . Bell DDS .
                      .............
                            /
                              IBM 3270 Protocol (Bysync)
                            / 9600 BAUD (Approx. one mile)

                      .............
                      . Bell DDS .
                      .............
                            .
                    .................
                    .   IBM 3705    .
                    .................
                            .
                 .......................
                 .      IBM 4341       .
                 .......................
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OFFICE AUTOMATION PILOT: A Paperless Approach

TECHNICAL

Implementation Schedule Summary

Description	FY81 JASONDJFMAMJ	FY82 JASONDJFMAMJ
Phase I		
- Select Support Team	BC..........	....
- Remodel Offices	BC..........	....
- 1 Month Pre-Install Study	.BC.........	....
- Install Cabling	.BC.........	....
- Install WANG OIS 140 System	.BC.........	....
- Train Support Team - WP	..BC........	....
- Train Administrators - WP	..BC........	....
- 1 Month Post-Install Study	...BC.......	....
- Train Support Team-Elec Mail	.....BC.....	....
- Train Administrators-Elec Mail	.....BC.....	....
- Train Support Team-Elec Cal	.......BC...	....
- Train Administrators-Elec Cal	.......BC...	....
Phase II		
- 1 Year Post Install Study	....	BC..........
- Develop Long Range Office Automation Master Plan	....	.B***C......
- Approve Long Range Office - Automation Master Plan	....	.....BC.....

B = Begin described activity
C = Complete described activity

OFFICE AUTOMATION PILOT: A Paperless Approach

FINANCIAL

Operating Budget Analysis

		FY 81	FY 82
Non-Office Automation Pilot			
Classified Staff (7) *	=	97,764	105,618
Hardware/Software Maintenance	=	1,950	1,950
Sub-Total - Current	=	99,714	107,568
Sub-Total - Cumulative	=	99,714	207,282
Office Automation Pilot			
Classified Staff (4) *	=	60,808	65,741
Hardware/Software			
Purchase	=	64,772	0
Maintenance	=	3,560	3,560
Less sale of 3 CRT's/2 Printer	=	(16,493)	0
Communications			
Data	=	1,300	1,100
Voice	=	6,500	0
Training	=	1,000	500
Install , Remodeling & Other	=	4,500	400
Sub-Total - Current	=	125,947	71,301
Sub-Total - Cumulative	=	125,947	197,248
Difference - Current	=	(26,233)	36,267
Difference - Cumulative	=	(26,233)	10,034

* Nine percent inflation factor used for salaries and $1500 used for benefit factor.

Revolving Cost Savings Fund

As a result of the planning which developed the Office Automation Pilot it became apparent that up front monies were required to get projects like this started. During this process the notion of setting up an internal funding mechanism to make "loans" to projects such as this was conceived.

After much discussion, it was decided to call it the Revolving Cost Savings Fund. In June 1980 the Board of

FINANCIAL

Trustees approved the creation of this fund with a balance of $150,000.

The fund is to be used to support projects that proposed to be able to reduce costs while maintaining or even increasing existing productivity levels. The savings engendered from a given project is then to be paid back to the fund from the respective operating fund.

Each project is required to be approved by the Board of Trustees on a project by project basis. As money is returned to the fund from savings, other projects are then funded. This approach has been used by some industries which have found the pay back in terms of increased savings and greater productivity to be excellent. C/D felt this would provide an incentive for administrators, faculty and staff to develop projects as they know the money is there and they would not need to compete with other priorities in the operating budget. Each project is judged on its own merits and funded if the pay back is adequate and the project deemed worthwhile.

The Office Automation Pilot became the first project to request a "loan" from this fund which was to be paid back over a period of two years with the savings realized from the reduction of staff from seven to four classified positions (secretarial type positions).

FUTURE

The future for office automation at College of DuPage is very bright. College of DuPage is very fortunate to have an excellent faculty, administrative, and support staff. In addition, there is a climate of excitement as planning begins for developing a long range office automation master plan.

It is hoped that the learning experiences derived from the Office Automation Pilot will provide the necessary techniques and insight required to bring office automation to all offices at College of DuPage in the near future.

WHO WILL RE-ORCHESTRATE THE WORLD'S KNOWLEDGE?

Dr. Edward J. Lias

Vermont State Colleges
P.O. Box 349
Waterbury, VT 05676

ABSTRACT

New technologies provide opportunities for the delivery of the world's knowledge directly to the home and office in forms which are easy to use and request. These opportunities are already being exploited by non-collegiate organizations which directly compete with universities in the education marketplace.

This address will present a global survey of these new technologies and the organizations which now use them, including the French and British videotext systems, the U.S. electronic newspapers, and the computer assisted video disk.

The legacy of man's rational mind - our ideas, discoveries, and traditions - have been uniquely preserved in the writings and pictures housed in the world's libraries. Universities have traditionally managed, catalogued, and dispersed this knowledge.

In order to retain this role as a primary custodian of knowledge, universities will use equipment and emerging technologies which are at the leading edge. Relationships with cable TV companies, video disk companies, computer companies, book companies, film companies, and communication companies will be required.

WHO WILL RE-ORCHESTRATE THE WORLD'S KNOWLEDGE?

Dr. Edward J. Lias

Once upon a time, a person who was hungry for information knew just what to do. First check the encyclopedia, then go to the community library, then, if really serious, sign up for a course at the nearest school or college.

Today, no single institution has a monopoly on the information marketplace. The information-hungry public has surrounded itself with a maze of electronic media which attempt to supply details to our minds at the speed of light. Television, radio, movies, microfilm, newspapers, and telephones compete with schools for the chance to deliver to us our facts or skills.

Not that all printed information is instantly available in the wristwatch or wallet, yet. Serious information seekers eventually take courses such as "Research 901", which give them special skills in extracting details from the books and journals which libraries hide away. The sheer physical size and bulk of most library holdings work against any hope of making their contents openly available and easy to get.

Because printed information is hard to obtain, schools have retained most of their clientele. All of our ideas, our discoveries, our traditions are uniquely preserved in the writings and pictures which are housed in the world's libraries. Universities have traditionally managed, catalogued and, through their courses, have dispersed this knowledge. Teachers assist students in browsing through these resources.

But new technologies are competing seriously for the chance to dispense the world's knowledge. Giant corporations funded by advertisers, and giant governments funded by tax dollars are finding ways to deliver the world's knowledge on instant ad hoc demand directly to our homes, offices, and community centers.

Schools never made it easy to obtain knowledge, considering the testing, grading, tuition costs, grade-point averaging, and rigid scheduling. Some students wait years to sign up for a course which is always full, or which is infrequently offered.

Thus, nearly everyone who chances to use the new Teletext or other systems which navigate the seeker through an easy path to the desired data, in 30 seconds or less, is probably pleased with it, as we shall see.

Opportunists are providing extremely popular, easy-to-use services which directly compete with the mission of the university; that mission being to vouchsafe and portion-out man's heritage of information. The competitors use three things in their systems which most universities already have: mainframe computers, terminals, and the telephone network.

Their methods of access are so simple and colorful that they point toward a gradual re-orchestration of the world's knowledge -- rearranging it into computer based forms which can be dispensed in dozens of ways, depending on the whim or mood of the user.

Three distinct forms of this re-orchestration can be identified which currently operate: (1) General Public Information Systems, (2) Specialty Data Banks, and (3) Curricular Learning Systems.

I.
GENERAL PUBLIC INFORMATION SYSTEMS

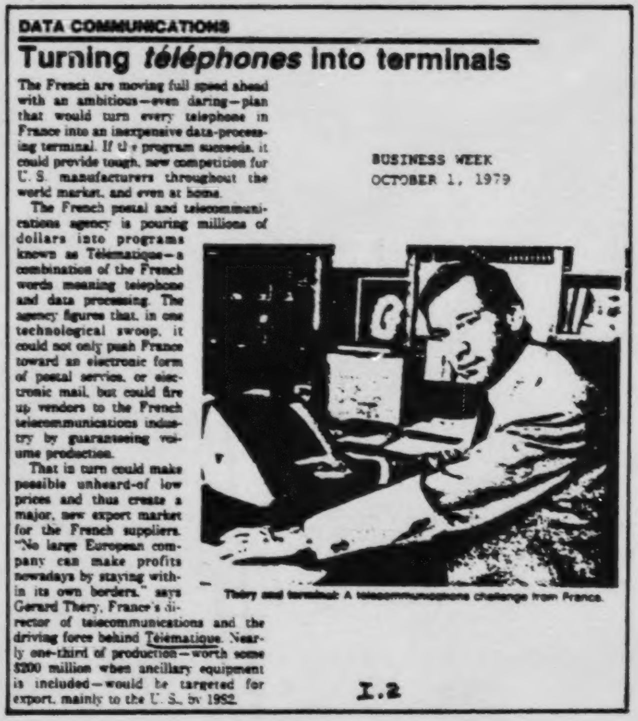
1. France: Telematique Programme.

France was the first country to bet 30 billion dollars on our hunger for information. Part of their plan for modernizing the telephone system is to discard the common phone from every home in France. In its place, a screen and small keyboard will be installed free of charge in every home. The normal voice handset on the side is incidental to its use.

250,000 devices are now installed, each device costing about $100. The funding for this project is advanced from the savings in not printing the white or yellow pages. All of that information will be available on the screen--on demand. The terminal will do the walking through the electronic pages. (See I.2.)

The simple savings in trees not cut for paper, and in not trucking heavy books to every office and home, probably pays for the device in a few years.

Meanwhile, the telephone company is re-orchestrating portions of the world's knowledge. The teletext system offers many other services beyond telephone numbers. Armchair shopping, reservations, electronic mail, travel information, entertainment listings, and other social or community directories are all available in simple, easy-to-request form. Behind the scenes, computers jocky more than 100,000 almanac-like pages of disk data down the phone lines to the demanding users.



DATA COMMUNICATIONS

Turning *téléphones* into terminals

BUSINESS WEEK
OCTOBER 1, 1979

The French are moving full speed ahead with an ambitious—even daring—plan that would turn every telephone in France into an inexpensive data-processing terminal. If the program succeeds, it could provide tough, new competition for U.S. manufacturers throughout the world market, and even at home.

The French postal and telecommunications agency is pouring millions of dollars into programs known as Télématique—a combination of the French words meaning telephone and data processing. The agency figures that, in one technological swoop, it could not only push France toward an electronic form of postal service, or electronic mail, but could fire up vendors to the French telecommunications industry by guaranteeing volume production.

That in turn could make possible unheard-of low prices and thus create a major, new export market for the French suppliers. "No large European company can make profits nowadays by staying within its own borders," says Gerard Thery, France's director of telecommunications and the driving force behind Télématique. Nearly one-third of production—worth some $200 million when ancillary equipment is included—would be targeted for export, mainly to the U.S., by 1982.

Thery and terminal: A telecommunications challenge from France.

I.2

2. England: Prestel and Viewdata

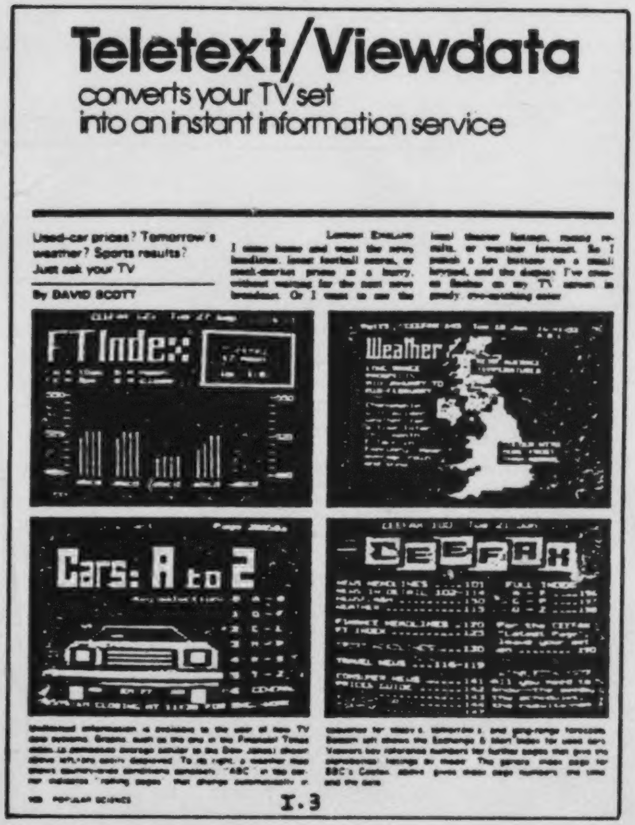
In England, the Post Office controls the communication channels and their electronic joybox is installed in 20,000 homes.

This system uses the standard (English) color TV set with a calculator-like button box which allows the information-seeker to pedal up and down through a menu of simple options. For instance, the first screen might give the options:

(a)	weather	(d)	library info
(b)	sports	(e)	airlines
(c)	wine sales	(f)	dept. store

The viewer can press a button on the box, and the screen might then fill with - "which airlines":

(a)	British	(d)	Pan Am
(b)	Scandanavian	(e)	American
(c)	TWA	(f)	Canadian



Teletext/Viewdata

converts your TV set
into an instant information service

Used-car prices? Tomorrow's weather? Sports results? Just ask your TV

By DAVID SCOTT

FT Index
Weather
Cars: A to Z
CEEFAX

I.3

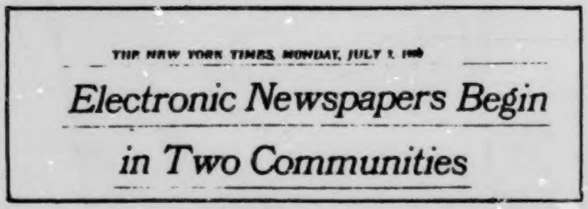
By pressing buttons, viewers can step down through seven levels of choices. (See I.3.) Some choices add a few shillings charge to the phone bill. At the Viewdata headquarters near Ipswich, 70,000 "pages" of information are stored on five GE 4080 computers.

Who organizes and enters the information? At the BBC TV center, newscasters feed their stories into keyboards, while graphics specialists create the pictures which accompany the text.

GTE is franchized to demonstrate and sell this service to U.S. firms, and they give demonstrations of it at various GTE centers throughout this country.

3. United States: Electronic Newspapers

The Columbus Ohio Dispatch was the first U.S. organization to stake a claim in the online public information arena. Unfunded by governments or grants, and undaunted by the lack of standards, they have successfully installed 3,000 home terminals which display any article or section of the newspaper - each day. (See I.4.)

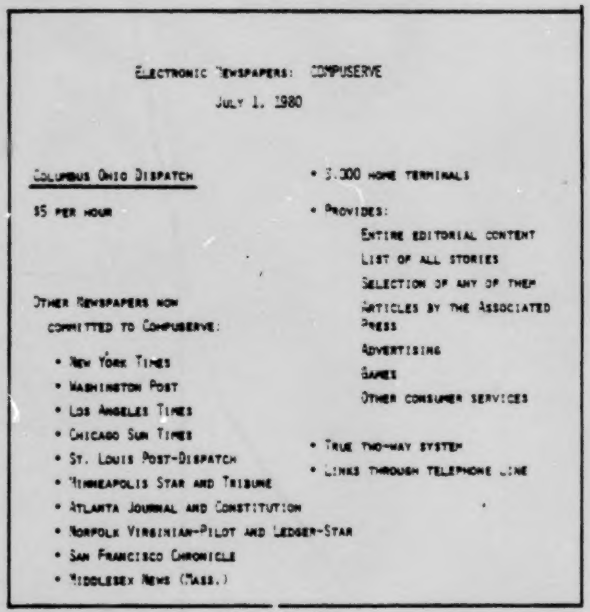


THE NEW YORK TIMES, MONDAY, JULY 7, 1980

Electronic Newspapers Begin in Two Communities

I.4

Since their newspaper is typeset out of word processing files (most are), the text is already on disk. With small revisions, it is re-orchestrated (daily) for delivery to the screens and printers in 3,000 homes. (See I.5.)



ELECTRONIC NEWSPAPERS: COMPUSERVE
JULY 1, 1980

COLUMBUS OHIO DISPATCH

$5 PER HOUR

- 3,000 HOME TERMINALS
- PROVIDES:
  ENTIRE EDITORIAL CONTENT
  LIST OF ALL STORIES
  SELECTION OF ANY OF THEM
  ARTICLES BY THE ASSOCIATED PRESS
  ADVERTISING
  GAMES
  OTHER CONSUMER SERVICES
- TRUE TWO-WAY SYSTEM
- LINKS THROUGH TELEPHONE LINE

OTHER NEWSPAPERS NOW COMMITTED TO COMPUSERVE:

- NEW YORK TIMES
- WASHINGTON POST
- LOS ANGELES TIMES
- CHICAGO SUN TIMES
- ST. LOUIS POST-DISPATCH
- MINNEAPOLIS STAR AND TRIBUNE
- ATLANTA JOURNAL AND CONSTITUTION
- NORFOLK VIRGINIAN-PILOT AND LEDGER-STAR
- SAN FRANCISCO CHRONICLE
- MIDDLESEX NEWS (MASS.)

I.5

The Knight-Ridder Project in Coral Gables, Florida, has a 1.5 million dollar underwriting for similar services to 200 homes - funding from Eastern Airlines, Sears, Merrill Lynch, and others.

With this system, viewers can receive 15,000 different screens on demand, including department store shopping, wine sales, boating tips, reference materials, and language lessons. Also, the API transmissions of 100,000 words per day are available live at all times.

Because of the funding from corporations and advertisers, the users pay no fee. The newspaper corporation will collect statistics on how many people are interested in tennis, food, science, birds, stamps, etc.

The Teletex system in Los Angeles adopts the French style of popular information delivery. Users learn to think of it as a giant magazine

(500 pages) with instant access to any page - except that it never gets old or out of date. It has 1 million dollars funding as a feasibility study. (See I.6.)

Computers were born and bred in Universities, but universities are not in the list of electronic teletext suppliers. Universities hold the wealth of the world's knowledge - both in their libraries and in the faculty whose wisdom they hire and vend.

Everything about the university prepares it to enter the electronic information business, but it has not yet pursued it. Declining enrollments do not occur because the desire for information is lower - it is probably higher than ever. Other agencies are communicating it to our homes - agencies like newspapers, post offices, and telephone exchanges. Without subject matter experts, without libraries, without classrooms, without land grants, without testing and grading, without much discipline, information is being distributed by non-scholastic agencies to a world which can't wait to get it. Why?

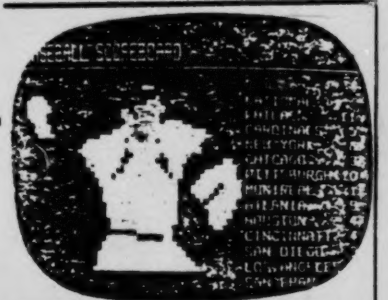
Several observations about this class of information service can be made. These systems rely on 3 things: large central machines, cable or telephone switching systems, and sources of information to send out to our homes. Alliances between universities and cable TV companies would thus be natural. Even the normal dial-up phone lines work well. They await the university vision.

These systems don't depend on micro-computers in the home. Whether you have a micro or not is unimportant.

TELETEXT (LOS ANGELES)
APRIL 1981

- USES THE FRENCH ANTIOPE SYSTEM
- USES PROGRAM INFORMATION FROM KNXT, KCET & WGBH
- ELECTRONIC MAGAZINE WITH 500 PAGES
- 1 MILLION DOLLAR FEASIBILITY STUDY

THE NEW YORK TIMES, FRIDAY, NOVEMBER 14, 1980



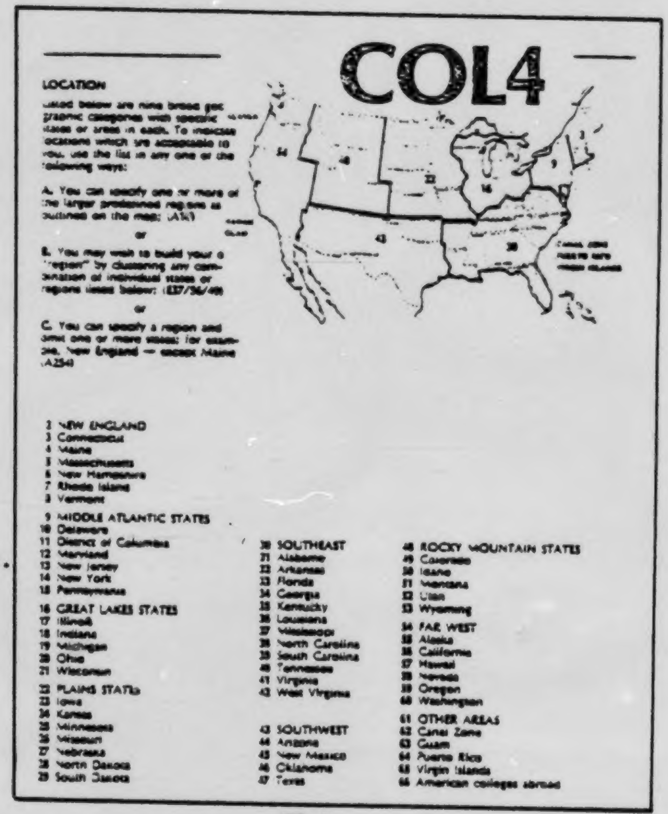
- SETS TO BE PLACED IN SCHOOLS, HOTELS, LIBRARIES AND HOMES.
    - NEWS
    - SPORTS
    - WEATHER
    - FINANCIAL
    - QUIZZES
    - GAMES FOR CHILDREN
    - CONSUMER TIPS
    - TRAFFIC REPORTS
    - CLASSIFIED ADS
    - AMUSEMENT LISTINGS
    - THEATRE & ENTERTAINMENT
- NOT FCC APPROVED.
- NO NATIONAL STANDARD.

I.6

The services might appear (today) to be outside the university arena. Scholars aren't important to the distribution of almanacs, bus schedules, and news stories. But, public services will blossom outward, I predict, to include college-like courses of all types on these public networks, especially after the statistics start to show the interests of the public users. Videotext systems appear to be distributing trivia, but it is just for practice.

II. Specialty Data Bank Systems

For the past ten years, researchers have been able to dial various phone numbers to attach their ($1,000) terminals to distant banks of data. The pediatrics data bank in New York State, the lawsuit data bank in New York City, the stock exchanges, and dozens of other specialty data banks are in use each day.


54
48
22
16
43
30

COL4

LOCATION

Listed below are nine broad geographic categories with specific states or areas in each. To indicate locations which are acceptable to you, use the list in any one of the following ways:

A. You can specify one or more of the larger predefined regions as outlined on the map: (A3)

or

B. You may wish to build your own "region" by clustering any combination of individual states or regions listed below: (B37/36/49)

or

C. You can specify a region and omit one or more states; for example, New England — except Maine (A2-4)

2 NEW ENGLAND
3 Connecticut
4 Maine
5 Massachusetts
6 New Hampshire
7 Rhode Island
8 Vermont

9 MIDDLE ATLANTIC STATES
10 Delaware
11 District of Columbia
12 Maryland
13 New Jersey
14 New York
15 Pennsylvania

16 GREAT LAKES STATES
17 Illinois
18 Indiana
19 Michigan
20 Ohio
21 Wisconsin

22 PLAINS STATES
23 Iowa
24 Kansas
25 Minnesota
26 Missouri
27 Nebraska
28 North Dakota
29 South Dakota

30 SOUTHEAST
31 Alabama
32 Arkansas
33 Florida
34 Georgia
35 Kentucky
36 Louisiana
37 Mississippi
38 North Carolina
39 South Carolina
40 Tennessee
41 Virginia
42 West Virginia

43 SOUTHWEST
44 Arizona
45 New Mexico
46 Oklahoma
47 Texas

48 ROCKY MOUNTAIN STATES
49 Colorado
50 Idaho
51 Montana
52 Utah
53 Wyoming

54 FAR WEST
55 Alaska
56 California
57 Hawaii
58 Nevada
59 Oregon
60 Washington

61 OTHER AREAS
62 Canal Zone
63 Guam
64 Puerto Rico
65 Virgin Islands
66 American colleges abroad

II.1

The owners of these data banks know that not everyone will want to use them. They are not marketing them to the general public, but rather to the serious researcher and specialist. Even so, there is money to be made in this marketplace because the specialist is willing to pay. For many specialists, timely information is power, and the computer meets this need ideally.

The data banks which these people access are usually large, too large to manage in the home or office. Many people buying into the central system help to make it possible to keep it up-to-date.

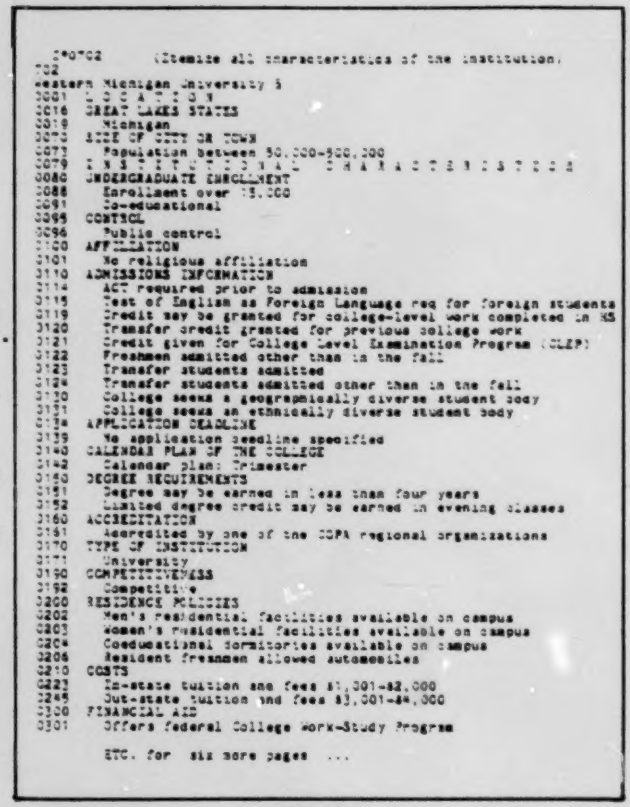
Ten to fifty data entry staff may be required to continuously enter the data in the re-orchestrated formats necessary for such electronic delivery systems.

One suggestive example will illustrate the worth of this class of service. TimeShare's Guidance Information System (Hanover, New Hampshire) provides (for a fee) six major files to any central computer. High schools and colleges in that area can then dial into the nearest computer.

If you wish to search for a college to attend in the Southwest United States, but not in New Mexico, with Protestant religious affiliations, and with an archery club, the GIS system will inform you immediately that 30 colleges qualify (for example). Using very simple commands (See II.1.), counsellors can narrow the search further and then print the entire description list of the selected schools.(See II.2. and II.3.)

Six large files are all accessible through the same system of commands. At the top of the run, the user states to the system which of the six files are desired. Professional counsellors use the occupational file to great advantage with students of all ages. Surprising financial aids are available from unexpected sources in the sixth file. (See II.4.)

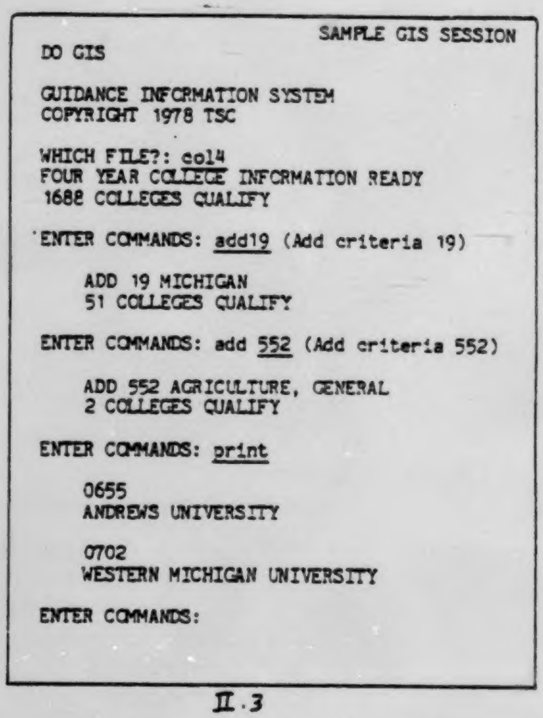
No single university or college would want to invest in the collection and re-orchestrating of this information. A large full-time staff collects and enters the dynamic data. It is a bargain at an $8,000 annual fee to a central computer, which may in turn sell the service to 10 or 50 other institutions for $1,000 per year.



```
  i0702      (Itemize all characteristics of the institution)
702
Western Michigan University 5
0001  L O C A T I O N
0016  GREAT LAKES STATES
0019    Michigan
0070  SIZE OF CITY OR TOWN
0073    Population between 50,000-500,000
0079  I N S T I T U T I O N A L   C H A R A C T E R I S T I C S
0080  UNDERGRADUATE ENROLLMENT
0088    Enrollment over 15,000
0091    Co-educational
0095  CONTROL
0096    Public control
0100  AFFILIATION
0101    No religious affiliation
0110  ADMISSIONS INFORMATION
0114    ACT required prior to admission
0115    Test of English as Foreign Language req for foreign students
0119    Credit may be granted for college-level work completed in HS
0120    Transfer credit granted for previous college work
0121    Credit given for College Level Examination Program (CLEP)
0122    Freshmen admitted other than in the fall
0123    Transfer students admitted
0124    Transfer students admitted other than in the fall
0130    College seeks a geographically diverse student body
0131    College seeks an ethnically diverse student body
0134  APPLICATION DEADLINE
0139    No application deadline specified
0140  CALENDAR PLAN OF THE COLLEGE
0142    Calendar plan: Trimester
0150  DEGREE REQUIREMENTS
0151    Degree may be earned in less than four years
0152    Limited degree credit may be earned in evening classes
0160  ACCREDITATION
0161    Accredited by one of the COPA regional organizations
0170  TYPE OF INSTITUTION
0171    University
0190  COMPETITIVENESS
0192    Competitive
0200  RESIDENCE POLICIES
0202    Men's residential facilities available on campus
0203    Women's residential facilities available on campus
0204    Coeducational dormitories available on campus
0206    Resident freshmen allowed automobiles
0210  COSTS
0223    In-state tuition and fees $1,001-$2,000
0245    Out-state tuition and fees $3,001-$4,000
0300  FINANCIAL AID
0301    Offers federal College Work-Study Program

    ETC. for  six more pages  ...
```

II.2



```
                                     SAMPLE GIS SESSION
DO GIS

GUIDANCE INFORMATION SYSTEM
COPYRIGHT 1978 TSC

WHICH FILE?: col4
FOUR YEAR COLLEGE INFORMATION READY
1688 COLLEGES QUALIFY

ENTER COMMANDS: add19 (Add criteria 19)

    ADD 19 MICHIGAN
    51 COLLEGES QUALIFY

ENTER COMMANDS: add 552 (Add criteria 552)

    ADD 552 AGRICULTURE, GENERAL
    2 COLLEGES QUALIFY

ENTER COMMANDS: print

    0655
    ANDREWS UNIVERSITY

    0702
    WESTERN MICHIGAN UNIVERSITY

ENTER COMMANDS:
```

II.3

A few universities have seen the wisdom of collecting data banks in areas where they are experts. The Institute for Social Research at the University of Michigan (Box 1248, Ann Arbor, MI 48106) publishes their "Guide to Resources and Services 1979-80". The book lists and indexes 300 large data files which have been collected by the 220 member universities and colleges.

For a fee, selected files can be mailed to local colleges for use on their central computers. Or, by dialing into Telenet, researchers and students can navigate through the data. The files cover a broad range of information - census data, economic, sociological, historical, psychological, political, organizational, electoral, urban studies, foreign policy, judicial, racial, and national data.

The university stockpile of information seems heavy and unyielding only because we have not yet re-orchestrated enough of it to be delivered through the electronic systems. The data banks above represent a first step in the re-orchestration, which allows us to get it out and use out. Universities collect information--why not also distribute it electronically?

The White House Conference on Library and Information Services met in March, 1980. They proposed that a comprehensive national library and information services program should be initiated. Its purpose would be to incorporate technology - the computers and satellites into the distribution of our national printed resources.

TimeShare
A Houghton Mifflin Company

GUIDANCE INFORMATION SYSTEM

Box 683
Hanover, New Hampshire 03755

THE INFORMATION FILES

The *Occupational Information File* (OCCU) contains approximately 850 primary occupational listings with reference to 2000 related occupations. Using GIS, you can find what aptitudes a job requires, how much education or training is needed to qualify, the kind of work involved, working conditions, salary ranges, and much more. An important feature of the Occupational File is a cross-referencing system that directs you to a wide variety of multi-media materials for more information about occupations.

The *Armed Services Occupations Section* (ASOC) can provide you with basic information about more than 100 occupations in the Armed Services. For each occupation you will get a general description, a list of related military occupations, and a list of related civilian occupations.

The *Four-Year College File* (COL 4) enables you to explore information about more than 1500 colleges and universities across the country. Using the GIS Guide, which lists over 500 characteristics for each college such as geographic location, size of student body, available majors, national test scores, costs, and various aspects of campus life, you may examine a variety of college options. The information found in the COL 4 file is supplied by the colleges and is updated each year.

The *Two-Year College File* (COL 2) lets you explore information about more than 1,200 two-year colleges and technical institutions in the country. It contains information on their program offerings, geographic location, size of student body, costs, and campus life. You can examine a list of over 300 characteristics about each school. The information found in the COL 2 file is supplied by the colleges, and it is updated each year.

The *Graduate School Information File* (GRAD), the newest file in the Guidance Information System, contains information on hundreds of graduate schools. Information is available about graduate programs offered, degree requirements, financial aid, placement, etc.

The *Financial Aids Information File* (AIDS) contains information about national scholarship and financial aids programs worth millions of dollars. A description of the financial aid offered, the eligibility requirements, application deadlines, and where to write for more information are provided.

II.4

Largest Academic Computer Installation
California State University and Colleges

$50 Million dollar hardware investment
Bid awarded September, 1980

- Increases number of student terminals from 1,751 to 2,747.
- 19 CSUC campuses.
- 74,000 students used computers in 76-77;
  166,000 students will use computers in 81-82
  (One terminal for every 60 students - 144 per campus).
- 21 Control Data Cyber 170/700 computers tie together statewide.
- Supports research, timesharing, and PLATO CAI.
- PLATO courseware covers 800 subject areas.
- PLATO carries more than 5000 hours of instruction.
- 2000 teachers and other professionals have contributed to the system.

III.1

Stated goals:

-- To reshape information services to serve the people in more useful ways.

-- To prevent monopolization of information services by an elite group of hardware or information vendors.

-- To socialize information so that individuals can be guaranteed the right to access information and to decide how it will be used.

President Carter invited all libraries and all telecommunication services to provide services to homes, businesses, agencies, and colleges. Re-orchestration will soon begin. Who will do it?

CONTRAST BETWEEN THE LEARNING ENVIRONMENTS

HUMAN INSTRUCTOR	INTERACTIVE ELECTRONIC INSTRUCTION
- Instruction is directed to the average student in the group.	- Learning rates for each individual are sensed by the computer and remedial or advanced themes are provided.
- Teachers will give lower grades to slower learners.	- Computers will give endless hours of extra drill or dialogue to slower learners.
- Teachers get their primary feedback at examination time.	- Computers get feedback at every interactive point, minute by minute.
- Teachers schedule class times at rigid hours.	- Learners call in for appointments with a computer terminal at any time. Terminals in the home can provide all subjects at all hours.
- Teachers are not at their best every time they perform.	- Computer based materials are tested and modified to obtain excellence in every module.
- Teachers may not keep their lectures up to date.	- Computer based materials can be updated every hour or week if required.

III. Curricular Learning Systems

A profound and costly re-orchestration of the world's knowledge is required when we attempt to prepare tutorial materials. The world's knowledge could be presented in question-and-answer form, etc., but someone has to prepare it for enjoyable, interactive delivery to the learner. Seventy hours of work may be required to obtain 30 minutes of computer aided instruction.

Three instances of significant investment in electronic curricular delivery will be described.

1. The science simulation programs at Emory University and at Irvine, California.

2. The PLATO systems from the University of Illinois.

3. The CAI typewriting and Nursing Math courses at Ocean County College in New Jersey.

STUDENT RESPONSES BASIC COMPUTER CAI COURSE

HOW DO YOU EVALUATE CAI IN GENERAL AS A METHOD OF INSTRUCTION?

(70.5%) A. MORE SATISFACTORY THAN A CLASSROOM SITUATION

(24.8%) B. ABOUT THE SAME SATISFACTION AS BEING IN A CLASSROOM

(4.5%) C. LESS SATISFACTORY THAN A CLASSROOM

IN OTHER CLASSES THERE IS MUCH SOCIAL INTERCHANGE.

(41.8%) A. YOU DIDN'T WANT SOCIAL INTERCHANGE; HAPPY WITHOUT IT

(47.8%) B. INTERCHANGE WITH THE TERMINAL SIMULATED A FRIENDSHIP

(10.2%) C. WISHED FOR MORE SOCIAL INTERACTION AND MISSED IT

III.3

CAI MODES

TEACHER
HIGHLY
INVOLVED

↑

1. PROVIDE A DRILL OR DEMONSTRATION AT A TERMINAL. HOMEWORK ASSIGNMENT
2. LENGHTY SET OF DRILLS. STUDENT STILL GOES TO CLASS. GRADE = 1/4 FINAL GRADE.
3. CONTINUING TERMINAL WORK. STUDENT REPORTS TO TEACHER MONTHLY OR WEEKLY.
4. FULL COURSE ON HARD COPY TERMINAL. STUDENT BUILDS A BOOK FROM HIS OUTPUT. PRESENTS BOOK TO TEACHER FOR EVALUATION.
5. FULL COURSE ON ANY TERMINAL - SCREEN O.K. ALL EVALUATIONS DONE BY COMPUTER. GRADE DEPOSITED IN STUDENT RECORD BY MACHINE.

↓

INSTRUCTOR
MINIMALLY
INVOLVED

LEARNING SYSTEMS ARE:

COMPREHENSIVE METHODS FOR ESTABLISHING A LEARNING ENVIRONMENT.

TYPICAL SYSTEMS:

TELEVISION LEARNING SYSTEMS
SLIDE AND AUDIO LEARNING SYSTEMS
AUDIO CASSETTE LEARNING SYSTEMS
CLASSROOM LEARNING SYSTEMS
COMPUTER-AIDED INSTRUCTION LEARNING SYSTEMS

INCLUDES:

- THE DESIGN OF CURRICULUM
- THE AUTHORSHIP OF CURRICULUM
- THE VENDING OF CURRICULUM
- CONTACT AND INTERACTION WITH LEARNERS
- CAPTURE OF STUDENT RESPONSES
- EVALUATION OF STUDENT RESPONSES
- METHODS OF ADJUSTING TO STUDENT NEEDS
- REPORTS TO ADMINISTRATORS OR TEACHERS
- METHODS OF DEMONSTRATING THE SYSTEM

1. WHO GIVES PERMISSION TO AUTHOR A NEW COURSE
2. WHO OWNS THE COURSE? FULL? PARTIAL? ROYALTY?
3. HOW MUCH CONTINUING FACULTY ASSISTANCE WILL BE REQUIRED?
4. CAN OTHER FACULTY FORCE AUTHOR TO CHANGE COURSE CONTENT?
5. WHO APPROVES THE CONTENT AND LEARNING OBJECTIVES?
6. WHAT INSTRUMENT WILL EVALUATE A NEW COURSE?
7. WHO DECIDES ITS WORTH AND PERMANENCE.
8. WILL CAI AUTHORS BE PAID TO TURN IN GRADES? TO MAINTAIN COURSE?
9. TERMINALS: ONE LOCATION OR MANY?
10. HOW LONG ARE STUDENT SESSIONS? FLEXIBLE?
11. WHO MAINTAINS COURSE AFTER AUTHOR LEAVES?
12. IS CAI AUTHOR "PUBLISHED" IN ESTIMATION OF DEAN?

In 1980, two large bids were awarded for computer hardware. The California State University system ordered $50 million of hardware to support 2,747 terminals throughout their 19 campuses. Note the persistence of mainframes. (See III.1.)

Also, the Houston Area schools purchased 600 microcomputer terminals for grade-school children to use.

The video disk, with its ability to hold 54,000 color slides or movie frames on one side of a disk, should complete the technology required to fully hold and distribute in interactive ways the subject matter which has yellowed in professors' notebooks long enough.

The classroom is not a perfect learning environment. A comparison of electronic vs. human instruction is presented in III.2. - the differences are significant and can be costly to a school that relies only on traditional lecturers.

Students at Ocean County College who received a Computer Literacy Course entirely from the terminal expressed their pleasure with it in the questionnaire responses which they gave to the computer (anonymously). (See III.3)

Conclusion

Bell Labs is proposing a microwave satellite which would sweep across the entire continent in 1/100th of a second - much like the scanning lightbeam in a TV set. Along the way, it would suck up packets of data from New York, then Chicago, then Seattle, etc., also dropping simultaneously the packets intended for any city. The packets of data

Narrow microwave beams from satellite proposed by Bell Labs would sweep U.S. ground stations, sending and receiving electronic mail and other information as packets of digital data. Concept would greatly boost signal-carrying capacities of satellites. Antenna to test idea (inset) steers two beams electronically; two reflectors magnify microwave fields.

IV. 1

from New York may be designated for San Francisco, Houston, and Tampa. Within 1/100th of a second, plus the satellite distance delay, they will have the information they requested - from anywhere. (See IV.1.)

What shall we do? Haines Gaffner (President of LINK Corp.) stated:

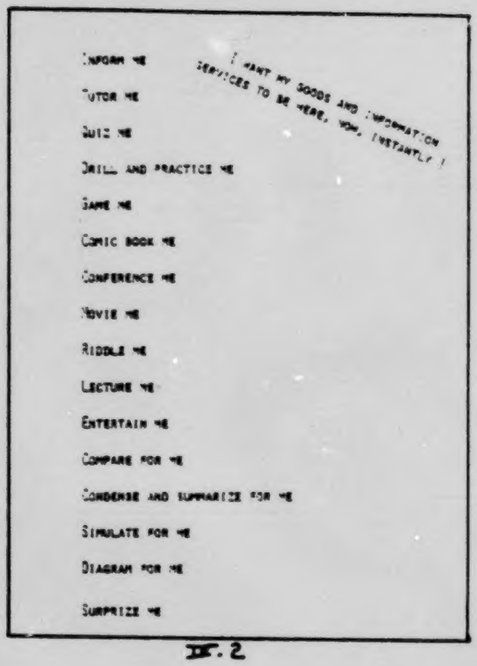
> "We are advising those who own information to experiment and get involved. Many owners of information are conservative and their attitude is to wait and let pioneers like Knight-Ridder do the experimenting."

Those who begin in 1980 to re-orchestrate their information holdings to computer-accessible form will become centers for national information exchange. Local networks will link into regional networks and regional services will interlace across the nation.

Slides IV.2. and IV.3. reflect the whims of John Q. Public. They were written in 1970 by this author. At that time, they appeared to be bizarre - even embarassing.

Nearly every electronic medium is computer assisted in 1980, and these lists seem reasonable and almost fulfillable.

The video screens on our walls will get larger and larger - and more necessary. Information from somewhere will dance across them. The world's knowledge will be re-orchestrated and universities with vision will have their place in the sun.



INFORM ME

TUTOR ME

QUIZ ME

DRILL AND PRACTICE ME

GAME ME

COMIC BOOK ME

CONFERENCE ME

MOVIE ME

RIDDLE ME

LECTURE ME

ENTERTAIN ME

COMPARE FOR ME

CONDENSE AND SUMMARIZE FOR ME

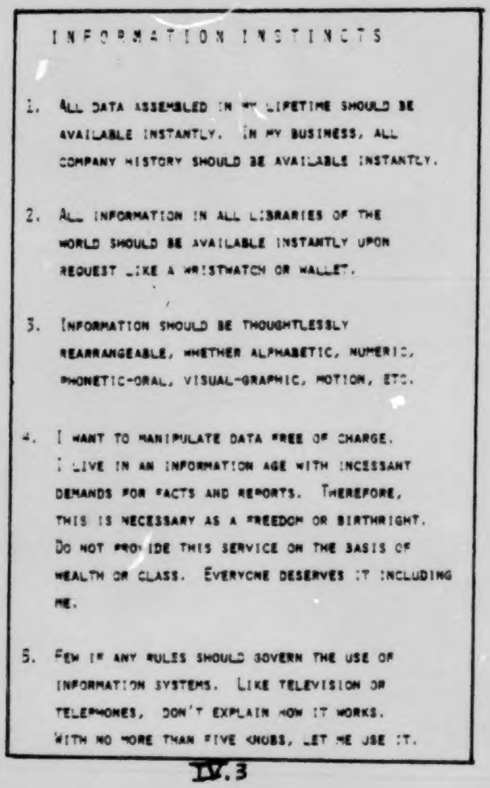
SIMULATE FOR ME

DIAGRAM FOR ME

SURPRIZE ME

I WANT MY GOODS AND INFORMATION SERVICES TO BE HERE, NOW, INSTANTLY !

IV.2



INFORMATION INSTINCTS

1. ALL DATA ASSEMBLED IN MY LIFETIME SHOULD BE AVAILABLE INSTANTLY. IN MY BUSINESS, ALL COMPANY HISTORY SHOULD BE AVAILABLE INSTANTLY.

2. ALL INFORMATION IN ALL LIBRARIES OF THE WORLD SHOULD BE AVAILABLE INSTANTLY UPON REQUEST LIKE A WRISTWATCH OR WALLET.

3. INFORMATION SHOULD BE THOUGHTLESSLY REARRANGEABLE, WHETHER ALPHABETIC, NUMERIC, PHONETIC-ORAL, VISUAL-GRAPHIC, MOTION, ETC.

4. I WANT TO MANIPULATE DATA FREE OF CHARGE. I LIVE IN AN INFORMATION AGE WITH INCESSANT DEMANDS FOR FACTS AND REPORTS. THEREFORE, THIS IS NECESSARY AS A FREEDOM OR BIRTHRIGHT. DO NOT PROVIDE THIS SERVICE ON THE BASIS OF WEALTH OR CLASS. EVERYONE DESERVES IT INCLUDING ME.

5. FEW IF ANY RULES SHOULD GOVERN THE USE OF INFORMATION SYSTEMS. LIKE TELEVISION OR TELEPHONES, DON'T EXPLAIN HOW IT WORKS. WITH NO MORE THAN FIVE KNOBS, LET ME USE IT.

IV.3

INSTITUTIONAL APPROACH TO WORD PROCESSING AND DOCUMENT PRODUCTION AT BOSTON UNIVERSITY

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December 5, 1980

ABSTRACT

In the last few years we, like others, have witnessed burgeoning interest in word processing, office records management, and bulk document production at all levels within the University. Until now, activities have been piecemeal and inadequately planned, resulting in an incompatible mix of equipment, poor vendor relations, poor computer support, and a general frustration from lack of direction.

While we are aware of much fine work that has been accomplished relative to specific application areas, Boston University has decided to adopt an institutional plan that addresses a broad range of related topics across many applications. The components of this plan include a departmental acquisition policy governing equipment selection and financing, a procurement review and justification procedure, a word processing service center, a generalized computer interface, and a methodology for handling bulk applications.

The paper covers issues concerning equipment standardization, selection criteria, and organizational and technical DP/WP interactions. On this last point, our aim is to make readily available the vast data resource from our traditional DP applications for purposes of correspondence and other document production.

INSTITUTIONAL APPROACH TO WORD PROCESSING AND DOCUMENT PRODUCTION AT BOSTON UNIVERSITY

INTRODUCTION

In the spring of 1980, the Executive Steering Committee for Information Systems decided that the level of activity in use and acquisition of word processing equipment warranted a more formal policy and orderly approach to exploiting this technology while controlling costs. Accordingly, in the summer, the Committee, which is made up of the Provost and three senior Vice Presidents, approved a program that addresses equipment standardization and financing, justification procedures, mass document production facilities for Admissions and Development applications, a computer interface for access to ordinary administrative data files, a word processing service center, and a consulting service. At this writing, it is possible to report qualitative success with the equipment acquisition policy and consulting services. Other components are still in various stages of implementation.

STANDARDIZATION

Given that most word processing systems perform most text editing functions reasonably well and also considering that no one word processing system performs all word processing functions in the best manner possible, one may very well ask "why standardize?"

The reasons for Boston University's decision to standardize deal with issues of operational redundancy, sharing of information, and ease of communications. If one needs access to additional word processing equipment due to an uneven workload, equipment failure in a department, or whatever reason, the chances of finding compatible equipment available in a one-vendor environment are much better than in an institution with many brands of word processing equipment. In an institution where information is often passed from one office to another, compatibility of word processing equipment is essential if material is to be revised rather than completely retyped. Of significant importance is ease of communication, in particular with our mainframe. Communications between word processing and data processing systems are not so easy as the vendors sometimes suggest. The vagueries of upper/lower case conversion, file structure, field designations, etc. can be quite cumbersome. It is obviously easier to have to deal with such issues in relation to one vendor only. In a multi-vendor setting, such issues are multiplied by the number of vendors that the institution deals with. The same holds true for communicating between word processors. While most vendors offer telecommunications, various format controls such as underscoring, centering and tabs are stripped off during communication and require a significant amount of "clean-up". Problems in communications between word processors are reduced by standardizing.

Other advantages of standardization that we foresee are cross-training of operators, sharing of applications, and transfer of equipment among users during growth periods. One other advantage we have achieved is in the realm of vendor relations. We have a modest price concession from our vendor and some leverage with respect to delivery and service concerns.

SELECTION CRITERIA

In searching for the vendor which would best meet our word processing needs we had four basic requirements.

1). Equipment had to be very easy to use
2). The vendor selected should have a wide product line
3). Equipment should be upgradable
4). Equipment must perform a wide range of functions reasonably well.

Ease of use. Recognizing that the University has a fair amount of secretarial turnover and that some individuals have a certain reluctance to work on a computer terminal, ease of use was a very important factor in our evaluation. The vendor that we selected uses "menus" to indicate functions such as selecting documents and creating new documents. In addition, separate "function keys" for insert, delete, move, copy, etc. are used rather than a series of keystrokes such as DE for delete, IN for insert, etc. The latter system seemed quite cumbersome although the literature on the topic does not cite this as a problem area.

It was this one criterion "ease of use" that turned us away from extensive use of word processing software on our mainframe as a major component of our word processing plan although some faculty do use these facilities. We felt that these mainframe systems lack adequate human engineering and are very difficult for a non-DP person to master.

Wide product line. If, indeed, we were to standardize, it was important that the selected vendor be able to accommodate both the user with very basic needs and the user with very sophisticated or high volume needs. In addition it was important all of that vendor's equipment be compatible (this is not always the case).

Upgradability. As the technology changes, and as departments' needs change, it is important that equipment can be upgraded without any "junking" of existing hardware or software. Although one can only guess what the technology holds for us in five years or so, we at least feel comfortable that we have a good deal of flexibility for the near future. The only way to preserve all one's options is never to invest in any technology that is likely to change - not an inviting prospect.

Wide range of functions. It is obvious that no single vendor can perform every function better than every other vendor. In our evaluation it was important that functions that were not supported strongly be at least adequate. Say, for example, that an institution was considering a vendor whose product performed many functions very well but offered absolutely no ability to handle super- and subscripts. If that were the only vendor to be allowed on campus, there would no doubt be a significant problem with some science departments. As it happens, the vendor that we have selected is weak in the super- and subscripts area; however, the system does handle them to an acceptable degree.

ACQUISITION POLICY

As mentioned earlier, Boston University has standardized on one manufacturer for its CRT-based word processing equipment. It is important to note that this policy does not apply to "blind" systems or memory typewriters. Since most equipment in this lower end of the word processing market has no off-line storage, compatability of storage media is not a relevant concern. In addition, the cost of such systems is much lower ($2,000 - $8,000) and therefore of much less financial concern.

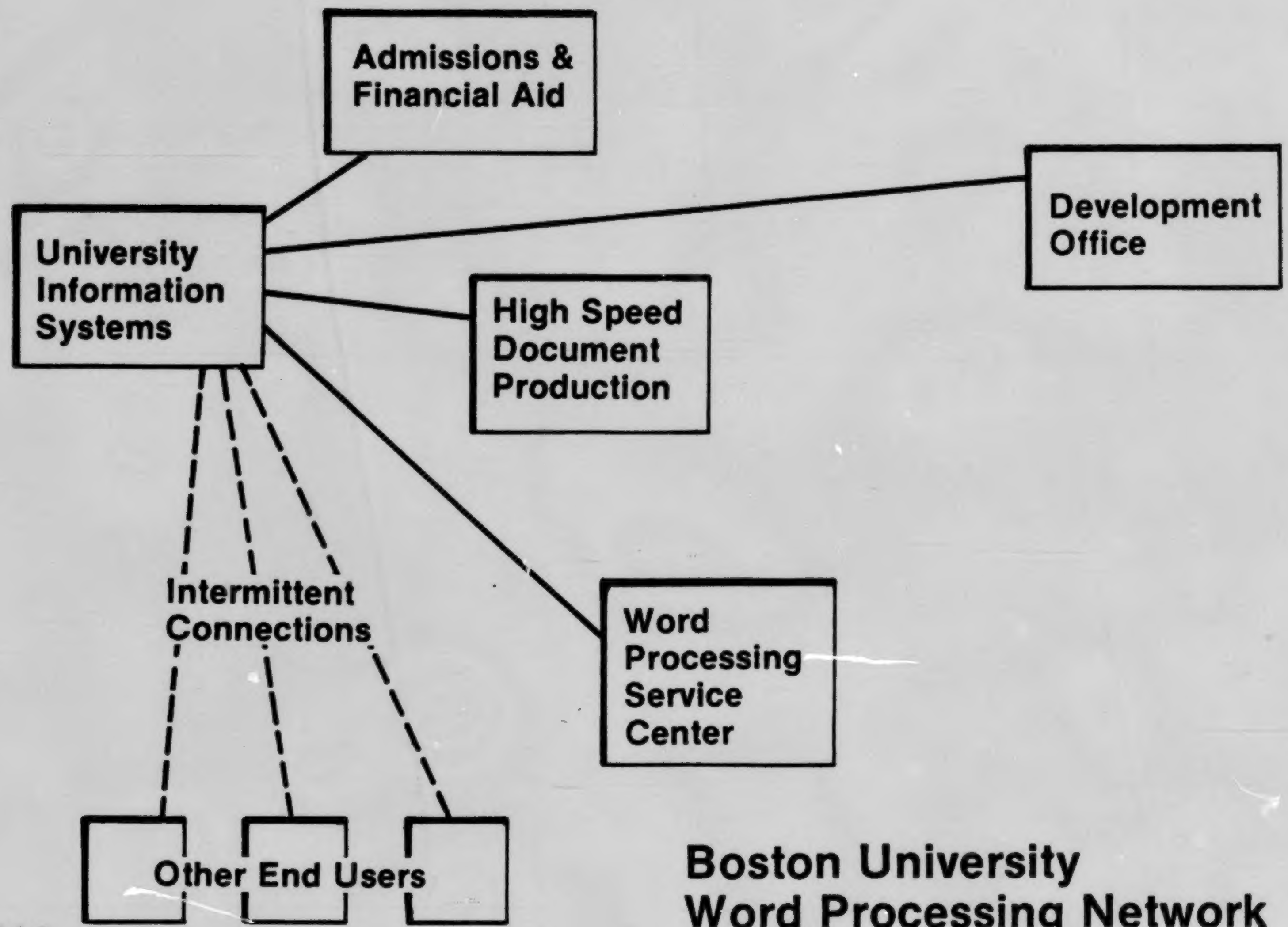
Before any word processing equipment can be purchased, even from the vendor that the University has selected, a written justification is required which specifies the type of equipment, cost, source of funding, space and personnel requirements, and proposed applications. This justification process is as much an effort to monitor the types of applications to be done on word processing as it is a process of justifying equipment expenditures. There has been a tendency in some of the schools and colleges to attempt to duplicate, on their word processing system, some of the functions that the University has performed centrally in the past (primarily the registration and alumni systems). This has led to additional policy statements which restrict the development and maintenance of systems and databases which already exist on the mainframe. Boston University feels strongly that the integrity of data in centralized files will best be preserved if users throughout the University are dependent upon those files for data. We do want to assure that all appropriate departments have access to these files but want to avoid duplication. This policy only applies to data which is needed by the University in some centralized fashion. There is obviously no problem in schools, colleges or departments maintaining their own data where that data is of a parochial nature.

MAJOR APPLICATIONS

The two areas which will be producing the highest volume of correspondence are the Admissions and Alumni/Development areas. Each of these departments will be upgrading their equipment substantially. In addition, these departments, and possibly others, will have access to a high speed letter quality document printer which is located in our administrative processing center. This machine is also being used for selected computer outputs. The diagram on the next page summarizes the configuration of this equipment.

Although the specifics of these two applications differ, many of their attributes are quite similar. The Admissions Office wants to correspond with prospective students and may want to tailor that correspondence depending upon geographic area, college of interest, date of acceptance, financial aid status, etc. The Alumni Office needs to correspond with particular segments of alumni for reunions, fund-raising, special alumni programs, etc.

In order to initiate one of these applications the user might, through the word processing terminal, ask the mainframe for the names, addresses, college, and date of acceptance for all prospective students that have been admitted to Boston University during the past five days. This process is possible since all applicants and all alumni are recorded on computer data files and can be queried using an easy-access query language. The selected information is then passed electronically to the word processing system. The information is then massaged if necessary, additional variables may be added, and text for the body of the


Admissions &
Financial Aid
University
Information
Systems
Development
Office
High Speed
Document
Production
Intermittent
Connections
Word
Processing
Service
Center
Other End Users

Boston University
Word Processing Network

letters is selected. The completed letters may then either be merged and printed on the local printer or, for high volumes, be sent back to the laser printer.

The reader should be aware that this description has been simplified somewhat. Issues such as upper/lower case conversion; field lengths; three, four, and five line addresses; multiple variables; communications protocols; etc. are not trivial to resolve.

Another application in which we have not yet become deeply involved but see excellent potential is in using word processing to cut typesetting costs. By giving a typesetting vendor a project on floppy diskettes rather than hard copy the vendor saves the cost of rekeying the entire document. A number of typesetting vendors have quoted savings of 30% to 50% of typesetting costs if we provide them with floppy diskettes. Although many typesetters accept only diskettes from certain types of word processing systems, they are gradually becoming more generic. Keep in mind that this 30% to 50% savings does not require the purchase of any typesetting equipment.

WORD PROCESSING SERVICE CENTER

In order to accommodate departments that do not have the need or the funds to purchase word processing equipment, and to accommodate overflow work from departments that do have word processing equipment, the University is opening a Word Processing Service Center. In addition to offering word processing capability to the entire University community, the Center will also have some additional features that individual departments may not have. Features such as communications, draft printers, twin track printer, advanced software, laser printer, etc. will be available through this center. It is anticipated that the availability of this Center will also forestall the need for some departments to acquire their own word processing systems. There is also an experimental component as the Center will be used to try out new applications, especially those involving interaction with the computer. The Center is expected to be self supporting with capital costs spread over three years.

CONCLUSION

Although we have made a significant effort to get the upper hand on the technology, planning for word processing is not a task that can be completed and then forgotten about. The technology is changing so fast that constant reassessment of word processing decisions is necessary if one is to capitalize on that technology. We are constantly looking for solutions such as less expensive methods of text entry, less restrictive communication between word processing terminals and CPUs, resolution of compatibility problems between systems, and so on. Both the degree of change and the amount of money involved in word processing dictate that continuous and detailed evaluations take place.

WORD PROCESSING: COORDINATION WITHOUT CENTRALIZATION

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Abstract

In February 1980, Rush-Presbyterian-St. Luke's Medical Center in Chicago appointed a task force to study word processing/office automation and to make recommendations for acquisition, implementation and administration at Rush. This presentation discusses the group's working approach, findings and conclusions.

The task force developed a three phase charge. The Phase I report, issued in July 1980, contained recommendations for a non-centralized institutional approach.

I. Introduction

Rush-Presbyterian-St. Luke's Medical Center is a large health care complex comprised of Rush University and Presbyterian-St. Luke's Hospital. The majority of its health care services are delivered through an 864 bed primary and tertiary care facility, a 176 bed geriatric center and a 138 bed acute care facility which is located 12 miles from the main complex. Twelve independent hospitals and a rehabilitation center are associated with the Medical Center through the Rush network.[1] Rush University consists of the Medical College, College of Nursing and College of Health Sciences. The total enrollment for 1980-81 is 1,152 students. An academic network, similar to the hospital system, has been developed with 15 colleges and universities in six states. Although this organization contains many highly specialized areas with unique and unrelated needs and output, common attributes permit generalized classification as educational, operational and research.

Administratively, the institution employs the concept of matrix management, a structure in which medical, nursing, and administrative personnel interrelate in a parallel framework. Because of the nature of this decentralized management structure, each division operates with relative autonomy.

II. Task Force

In February 1980, the Assistant Vice Presidents/Associate Administrators appointed a task force to research word processing and its potential application at the Medical Center. Word processing was a new technology and systems were being acquired sporadically throughout the complex. As the number of requests for word processing equipment increased, it was readily apparent that significant capital expenditures or long-term lease commitments would be necessary. Thus, the initial impetus was to provide information and guidance in dealing with these issues.

Of equal concern was the fact that Rush had approximately 1000 clerical positions in a total workforce of 6700 full-time employees. Despite the size of this staff, new secretarial positions continue to be requested. If Rush had less competition for qualified secretaries, the issue of substituting equipment for labor might not be raised. However, the Medical Center is located in the inner city west of the Chicago Loop. Rush is only one of three complexes located in this area that provide health care services. Thus, the competition for office personnel is keen, and salary costs have increased at a high rate to attract employees. Although several word processing systems were already in use at Rush, it was not an automatic assumption that this equipment provided the solution to the secretarial support problem. There was substantial uncertainty about the ramifications the acquisition of word processing might have on the Medical Center.

The nine member task force represented both operational and academic divisions. The members had varied backgrounds and only three persons could be described as having data processing experience. The remaining six members were primarily involved as departmental managers responsible for daily operations of their respective areas. Only two or three of these individuals had a working knowledge of word processing equipment.

The Administrators directed the task force to develop its own charge. The Assistant Vice President/Associate Administrator for Information Processing was delegated as the liaison between the two groups and, as such, asked his appointee to oversee activities of the task force.

Initially, the task force met on a weekly basis. During the first four sessions, the group deliberated extensively to define the charge and to design the mechanism for accomplishing it. Because of the limited direction given, the group was free to orient itself in numerous ways and to pursue whatever approach seemed best.

The task force developed the following charge:

1. Research word processing as a potential tool for optimization of office productivity at Rush-Presbyterian-St. Luke's Medical Center;

2. Identify operational, administrative and cost issues pertinent to the Rush environment;

3. Recommend an approach to acquisition, implementation and administration of word processing services.

The strategy that the task force chose to follow was divided into three phases. Phase I consisted of a study of word processing and needs assessment. It included: delineating the impact of word processing technology on the institution with respect to planning, operational and personnel considerations; conducting a survey of current users at the Medical Center; determining categories of word processing services and generic needs filled by these services; and finally, defining word processing vs. information processing. The task force planned to issue a formal report of its findings and recommendations at the end of Phase I. It was estimated that this phase would be completed by July 1, 1980.

During Phase II, the task force projected that specific policies and procedures for system evaluation and application would be formulated. An important aspect to be included in the evaluation procedure is a cost/benefit analysis. Specifications for equipment selection and acquisition would be developed, and strategies would be designed for implementation and administration of word processing services at Rush. Phase III was designated as the period in which the recommendations would be implemented.

After the overall strategy was designed, the task force split into two subgroups which worked simultaneously on various aspects of the study. No formal criteria were established for dividing the group, and each team represented a cross-section of the entire task force. Team 1 directed its attention to the external environment. Members concentrated on market surveys, vendor exhibits, site visits, and literature review. Team 2 concentrated its efforts on the internal environment. A survey form was designed, and interviews were conducted in departments using word processing equipment. The survey addressed topics including: the selection process, feasibility studies, satisfaction with the system being used, desired changes, cost impact, and documentation of pertinent information volunteered by the persons being interviewed. Members from team 2 also participated in site visits. At two-week intervals, the task force met formally to review the progress made by each team and to alter the strategy as indicated.

Various members of the task force contributed reports on specific aspects of the study, and each team summarized its findings. The final report[2] submitted to the Assistant Vice Presidents/Associate Administrators contained an overview of the project, a background section on word processing technology, the operational plan designed by the task force, and the recommendations for a non-centralized institutional approach.

III. Discussion and Recommendations

The task force concluded that word processing offered a mechanism for increasing productivity, generating higher quality copy, and containing office costs in the Rush setting. Although the time for text input remains approximately the same, the capability for editing and manipulating text and for printing at high speed greatly reduces output time compared to that of standard office equipment. This is especially beneficial when numerous revisions are made, repetitive text is generated, or standard copy is routinely updated. Because printing of the copy is a separate function from text entry, the potential for batch output exists. Work time gained can be redirected to other tasks. While the actual number of employees may, or may not, be reduced, it is often possible to avoid adding positions despite an increased workload.

In addition to the potential benefits of word processing per se, it became apparent to us that word processing technology represented a beginning of the concept of office automation for Rush. The ultimate integration of word and data processing systems, electronic mail, information telemetry, and other technologies could enable the Medical Center to build an effective communications network.

Today, we communicate extensively by written documentation. The typewriter and copy machine have facilitated creation of an ocean of paper; the amount and cost of which is staggering. Inflationary pressure is forcing all of us to reevaluate these practices.

At Rush, we have been fortunate to have access to the latest equipment. There is little reluctance to try something new, and most divisions are eager to serve as a testing ground. By acquiring a number of different word and data processing systems, the institution could easily be equipment-rich and communications-poor.

At the time of this study, a number of word processing systems were already on-site. The task force was concerned that future system integration would not be possible. To address this issue, the group strongly endorsed development of a long-term institutional plan for word processing and office automation. An important part of this plan would be the ability to interface each additional system with those already operating and, thus, extend the capabilities of the total system. Although system integration could be a chronic problem, careful long range planning can enhance the benefits of this technology.

Having recommended acquisition of word processing equipment, the task force next considered strategies for administration of equipment and personnel. The literature on office planning focused on three basic configurations: (1) a centralized function; (2) cluster arrangements; and (3) one-on-one equipment.

Providing each potential user with a terminal is obviously the most attractive alternative from a psychological viewpoint. It is not, however, very attractive when the cost is considered. Not only would the acquisition cost be enormous, but the issue of recycling existing equipment should also be considered. Few institutions could afford to replace an entire office equipment inventory.

A number of organizations have created centralized word processing functions.[3] The office personnel structure has been redesigned, and guidelines and mechanisms for submission of copy have been established. The majority of correspondence and reports are directed to these centers. If the traditional secretary/boss relationship exists, implementation of this concept can be extremely difficult even when mandated by top management.

Another drawback of centralization has been the revival of the old "typing pool" morale problems. The literature contains a number of articles addressing this issue and describing the strategies that companies are using to help overcome these problems. Some companies have implemented a complex web of job categories, salary steps and titles in order to provide a sense of mobility to word processing operators.

In our environment, we felt that severing staff relationships would be a virtually impossible task. It is doubtful whether the gains would outweigh the demoralizing effect on the personnel involved. While any approach may affect job descriptions and raise salary issues, the task force hoped to avoid personnel problems of this magnitude.

The task force felt that effective cluster arrangments could be developed. As currently designed, word processing units lend themselves to integrated system development. A shared-logic system consisting of a central processor supporting several CRT units and printers would provide a powerful system to be used by multiple departments or several people in one department. Security for each user would be assured by "lock out" or password entry features of the equipment. Standalone units could be used to augment the cluster equipment for remotely located departments. A potential secondary benefit of these equipment clusters is to more evenly distribute the workload among the cluster personnel.

In a survey of Rush users, team 2 had discovered that only one of 14 offices had performed any type of feasibility study. None had measured productivity either before or after word processing was implemented. Although the departments interviewed generally thought productivity had improved, there was no way of knowing whether they had applied the best, or the worst, solution for their particular situation.

We feel a key element in implementing this concept is to establish a position of office automation coordinator reporting to the Assistant Vice President/Associate Adminstrator for Information Processing. All requests for equipment would be channeled to this office, and a feasibility study would be an integral part of the request process. After equipment installation, the coordinator would direct periodic productivity measurements. Guidelines and standards for measuring productivity would be developed and applied uniformly in all departments.

As the institution's coordinator, this individual would have an overview of office support not apparent to the manager, or administrator, who looks only at a specific area of responsibility. In a decentralized management structure, centralized coordination appears to be an important element in the optimal and efficient implementation of word processing and office automation. Even with centralized management, the scope of such a project requires full-time commitment.

Some of the institutions visited by the task force had purchased all equipment from a single vendor. We were impressed by the many administrative, operational, and cost advantages of this approach. However, we did not recommend this for Rush. A wide range of legitimate functional needs exists in our Medical Center. It seemed unlikely that a single vendor could serve them all equally well, and many specialized departmental needs would be subordinated to the common requirements of the majority.

The task force recognized that high quality performance was critical to institution-wide acceptance and felt that adequate flexibility could be achieved with three vendors and types of equipment. This strategy largely retains the advantages of a single vendor, serves the legitimate needs of the user community, and retains task force credibility with both management and users. One additional advantage of selecting several vendors is reduced financial vulnerability in the event a vendor leaves the market.

The task force did not attempt to make specific vendor and equipment recommendations. We provided general selection criteria and considerations. These included: operational functions and features; ease of use; training arrangements; maintenance; upgrade potential for both hardware and software; data and hardware security; configuration flexibility; ability to communicate with other equipment; and financial stability of the vendor. We felt that many of these considerations are equally, if not more important, than the operational functions. The importance of researching financial stability was emphasized when a vendor whose equipment was installed at Rush, and was most popular with task force members, went out of business. In our survey of current users, we had learned that an unsatisfactory training arrangement can be a source of unexpected hidden costs and serious morale problems.

Making the decision to acquire word processing equipment is relatively easy when compared to determining how to finance the acquisition. Choosing a financing method is always a challenge to management, and the final decision often depends on the availability of cash. If funds for capital expenditure are tight, leasing agreements enable extension of the payment period. Quite often, it is possible to include lease funding when yearly budgets are prepared. Thus, a large one-time capital outlay is avoided.

In our own institution, the financial pressure is in the direction of purchase rather than lease. This approach involves a one-time expense and a per unit lower cost than leasing. Unfortunately, it provides no protection against making an incorrect choice initially, vendors leaving the market, or technical obsolescence.

At present, the word processing market is undergoing rapid technological development and is highly competitive. These factors make this market reasonably unstable with the number and composition of firms changing as it stabilizes. This condition creates uncertainty for long-term service support. Leasing equipment provides some protection against market instability and technical obsolescence. If a firm does leave the market, the institution can either replace the equipment at the end of the lease period or negotiate a settlement to terminate the lease early. Another advantage is the potential to upgrade a system as newer technology appears. In a lease situation, the vendor has a greater incentive to upgrade a system to the customer's satisfaction than if the customer owns the equipment.

The current allocation of capital funds at Rush is at the divisional level. As an alternative, the task force recommended creation of a centrally funded and administered equipment pool. Equipment would be placed in departments as justified by a feasibility study. Periodic productivity measurements would be required. If the volume of work or its nature changed, the equipment could be changed or reassigned. The primary motives in this approach are dollar savings, a gradual plan for acquisition of equipment, and fully productive use of each system acquired.

This approach is not without drawbacks. There is always an inherent difficulty in placing "used" equipment. A second obstacle is the political problem involved in reassigning equipment from one area to another. Because of the flexibilities of the cluster concept, and, if departmental needs are truly served, these issues may not become significant problems.

Because of Rush's size and diverse needs, a proposal to lease two or three systems was made. Planning prior to acquisition and careful documentation of performance would enable a meaningful evaluation of how well these systems satisfied needs. This strategy would allow on-site evaluation without the necessity of capital expenditure.

One other financing approach is possible. That is to recognize accelerated depreciation due to rapid technological change. Equipment would be purchased outright thus avoiding the financing charge inherent in leasing. If the equipment became outdated or obsolete, replacement would occur earlier than the traditional depreciation schedule.

IV. Future

The task force completed its work and submitted the Phase I report in July. The task force believes that the committee approach has served well the needs of the institution thus far. To successfully complete the Phase II objectives, more expertise and a substantial time commitment will be required. The task force believes that the office automation coordinator could best fulfill these requirements. A primary goal for the upcoming months will be to develop broad support for a coordinated institution-wide approach to word processing.

Acknowledgments

The authors gratefully acknowledge the contributions of the task force members in making this report possible. These individuals are: Marilyn Bonilla, Lisa Brenner, Sarah Howard, Scott Kaminski, Marilyn LeFager, Stacy Sochacki and Yvonne Thomas. The authors also wish to thank Sandra Velasco for her assistance in preparing the manuscript.

References

[1] Jeff C. Goldsmith, "The health care market: Can hospitals survive?", Harvard Business Review, September-October 1980, p. 100.

[2] Cheryl Stoneking and Sandra Seim, Report of the Word Processing Task Force (Chicago, Illinois: Rush-Presbyterian-St. Luke's Medical Center, 1980).

[3] Lawrence Rout, "Many Managers Resist 'Paperless' Technology For Their Own Offices", The Wall Street Journal, June 24, 1980, p. 1.

DBMS: A RETROSPECTIVE AND PROSPECTIVE VIEW

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This paper summarizes the preliminary findings of the CAUSE survey of institutions of higher education utilizing data base management systems. The primary area of concern that this report will focus on is the impact of the use of a DBMS on: the systems development life cycle, programming productivity, operations and management.

During the last ten years (1970-1980), we have witnessed an increased use of data base management systems (DBMS) in a variety of settings in higher education. Initially, this use may have simply been a fad since DBMS was certainly the new buzz word of the early 1970's. However, there undoubtedly existed a real desire for file integration as a building block to management information systems (MIS) in some quarters.

As a former director of an installation (one of the early users) of a DBMS, and as an observer and researcher of the higher education scene during the 80's, this author became interested in the post-implementation experiences of the institutions that had made the decision to install a DBMS. Thus, it is in this context that this research was undertaken, and the findings reported in this paper are the preliminary observations based on a 47.7% response (n equals 54) of 111 users of DBMS.

The initial hypotheses upon which this research was based are presented in Figure 1. and as we shall see in the analysis of the data, the findings belie many of these initial hypotheses.

The process of identifying the users of DBMS was as follows:

1. a questionnaire was sent to CAUSE members during 1980 requesting that they identify all software utilized;
2. a request was sent to selected higher education users of the major DBMS asking them to identify other installations currently utilizing the system;
3. the CAUSE and CUMREC proceedings were reviewed to identify additional users; and
4. this author had accumulated lists of users over the past ten years.

The questionnaire was drafted in the summer of 1980 and a pilot test was conducted. This consisted of asking selected users to critique the instrument. The final instrument was sent to 111 institutions in October 1980 and responses were collected through December.

Forty-seven out of the 54 institutions that responded were currently utilizing a DBMS. The earliest users identified were in 1970 (three institutions) and there has been a steady growth in the number of institutions installing DBMS with four in 1974, six in 1975, seven in 1978, eight in 1979 and seven in 1980 (partial year).

A number of measures were utilized to determine the relative impact of the use of the systems. These ranged from simply asking them whether the objectives were satisfied, to the impact on systems design, programmer productivity and operations, and questions about future use.

A review of Figure 2. indicates that 60 percent of the respondents satisfied all their objectives or satisfied their objectives to a considerable extent. Such is also the case with their second and third objectives with 64.3 percent satisfying all or considerable number of the second objectives and 57.5 percent the third objectives.

My initial hypotheses (see Figure 1.) were that there were no specific gains in design time and that the main advantage was related to programmer productivity.

The data in Figure 3. indicates that there is a negative impact on design time in the first application system as over one-half of the cases reporting (26) indicated that there was an increase in the amount of time required to design a system up to the point of programming. Such was not the case in the second application since an equal number of respondents (14) indicated that there was an increase and decrease on the time required for design.

This is further broken down in the various stages of the systems development life cycle in Figure 4. An analysis of this data indicates that there isn't any impact on project initiation or defining user requirements, and the major gain is in simplifying programming and testing. Forty-five percent of the respondents indicated that it simplified installation.

The question on programmer productivity sought to differentiate the impact on productivity for the first versus subsequent applications. As was anticipated, the use of a DBMS decreased the productivity of programmers on the first application. This is substantiated by the fact that 57.1 percent indicated a decrease in productivity (see Figure 5.). Similarly anticipated was the increase in productivity on subsequent applications. Sixty-one percent of the respondents indicated that they experienced an increase in productivity.

As regards the operational impact and whether or not the use of a DBMS complicated or simplified one's life, a review of Figure 6. seems to indicate the following:

a. in general, computer operations was complicated;

b. there is not any clear impact on logging, backup or recovery;

c. the teleprocessing interface is simplified as is file handling;

d. clearly there is a negative impact on the interface of data base and non-data base file; and

e. there seems to be somewhat of an increase in the simplicity of planning backup and recovery.

Contrary to this author's initial hypothesis which suggested that few integrated reports were available for upper management, the data in Figure 7. suggests the following: not only is more integrated (cross-application) information available as a result of the use of DBMS for operational functions, such data is also available for management decision making.

As regards the question of whether the use of a DBMS is an essential building block in the development of a management information system, there is little doubt remaining since 76.1 percent indicated that it is essential.

The questionnaire also sought to determine whether institutions would repeat the decision "go data base" and whether there was a high likelyhood of future use. It appears that few institutions regret the decision to install a DBMS since 95.7 percent would make the same decision and 80.6 percent would acquire the same DBMS (see Figure 9.).

Finally, as regards future use, few institutions (10.7 percent) see little or no possibility that a DBMS will be in use at their institution in the future.

In summary, how can we evaluate the results vis-a-vis the initial hypotheses stated in Figure 1. Clearly, the hoped-for positive impacts of the use of a DBMS have been realized:

1. There is strong evidence of an increase in programmer productivity after the first application is installed.
2. DBMS is used to integrate files within and across similar application systems.
3. The implementation of a DBMS has a significant impact on the control over the programming activity.
4. The function of data base administration (DBA) is almost always created or added to current tasks.
5. Consultants are infrequently used.
6. DBMS is indeed viewed as an essential building block for MIS development.
7. There is an adverse impact on operations in general.
8. Most institutions would once again acquire a DBMS. And,

9. There is a high likelyhood of future use.

On the other hand, contrary to my initial hypotheses:

1. DBMS is used to integrate institutional data.
2. More integrated (cross-application) information is available as well as operational functions.
3. There were significant gains in system design.
4. There were no adverse impacts on logging, backup and recovery. And,
5. Perhaps most important, most institutions did indeed meet all of, or considerable number of, their desired objectives as a result of the use of a DBMS.

HYPOTHESES

- DBMS NOT USED TO INTEGRATE INSTITUTIONAL DATA
- DBMS USED TO INTEGRATE WITHIN APPLICATION
- USED TO CONTROL PROGRAMMERS
- FEW INTEGRATED REPORTS FOR UPPER MANAGEMENT
- MAIN ADVANTAGE IS PROGRAMMER PRODUCTIVITY
  - DECREASE ON FIRST APPLICATION
  - INCREASE ON SUBSEQUENT APPLICATIONS
- NO SPECIFIC GAINS IN SYSTEMS DESIGN
- DBA CREATED OR ADDED ON TO CURRENT TASKS
- CONSULTANTS INFREQUENTLY USED
- MAIN DIFFICULTIES IN OPERATIONS ARE
  - LOGGING
  - BACK-UP
  - RECOVERY
- MOST WOULD ACQUIRE DBMS AGAIN
- FEW INSTITUTIONS MEET ALL OR CONSIDERABLE # OF OBJECTIVES
- HIGH LIKELYHOOD OF FUTURE USE
- ADVERSE IMPACT ON TERMINAL RESPONSE TIME
- SIGNIFICANT DIFFERENCE IN EASE OF USE,
  - THROUGHPUT AND SATISFACTION BY SYSTEM
- DBMS IS AN ESSENTIAL BUILDING BLOCK FOR MIS DEVELOPMENT

Figure 1.

OBJECTIVES SATISFIED

	#1		#2		#3	
	n	%	n	%	n	%
1. NONE	1	(2.2)	2	(4.8)	1	(2.5)
2. CERTAIN EXTENT	17	(37.8)	13	(31.0)	16	(40.0)
3. CONSIDERABLE EXTENT	24	(53.3)	20	(47.6)	21	(52.5)
4. ALL	3	(6.7)	7	(16.7)	2	(5.0)
5. NO RESPONSE	2	--	5	--	7	--
MEAN	2.64		2.76		2.6	

Figure 2.

IMPACT ON DESIGN TIME

	APPLICATION			
	1st		2nd	
	n	%	n	%
1 - NO IMPACT	9	(21.4)	7	(20.0)
2 - INCREASED	26	(61.9)	14	(40.0)
3 - DECREASED	7	(16.7)	14	(40.0)
NO RESPONSE	5		12	
	47		47	

Figure 3.

IMPACT ON SYSTEMS DEVELOPMENT LIFE CYCLE

	1-COMPLICATE		2-SIMPLIFY		3-NO IMPACT	
	n	%	n	%	n	%
a. PROJECT INITIATION	11	(25.0)	9	(20.5)	24	(54.5)
b. DEFINING USER REQUIREMENTS	9	(18.2)	13	(29.5)	23	(52.3)
c. SYSTEMS DEFINITION	15	(34.9)	16	(37.2)	12	(27.9)
d. SYSTEMS & PROGRAM DESIGN	15	(34.9)	20	(46.5)	8	(18.6)
e. PROGRAMMING & TESTING	17	(38.6)	23	(52.3)	4	(9.1)
f. INSTALLATION	11	(26.2)	19	(45.2)	12	(28.6)

Figure 4.

MORE INTEGRATION OF DATA FOR

	MANAGEMENT DECISION-MAKING		OPERATIONAL FUNCTIONS	
	n	%	n	%
1-YES	30	(69.8)	32	(74.4)
2-NO	6	(14.0)	8	(18.6)
3-NO IMPACT	7	(16.2)	3	(7.0)
NO RESPONSE	4		4	
TOTAL	47	100.0	47	100.0

Figure 7.

IS DBMS AN ESSENTIAL BUILDING BLOCK TO MIS DEVELOPMENT?

	n	%
1. YES	35	76.1
2. NO	9	19.6
3. NO IMPACT	2	4.3
NO RESPONSE	1	
TOTAL	47	100.0

Figure 8.

	1-NO IMPACT		2-INCREASE		3-DECREASE	
	n	%	n	%	n	%
IMPACT ON PROGRAMMER PRODUCTIVITY						
1st APPLICATION	3	(7.1)	15	(35.7)	24	(57.1)
2nd APPLICATION	9	(25.0)	22	(61.1)	5	(13.9)
IMPACT ON PROGRAMMER (CONTROL OVER)	11	(27.5)	25	(62.5)	4	(10.0)
IMPACT ON DP MANAGEMENT PRODUCTIVITY	20	(50.0)	14	(35.0)	6	(15.0)

Figure 5.

OPERATIONAL IMPACT

		1-COMPLICATE		2-SIMPLIFY		3-NO IMPACT	
		n	%	n	%	n	%
a.	OPERATIONS	22	(51.2)	14	(32.6)	7	(16.3)
b.	LOGGING	16	(40.0)	13	(32.5)	11	(27.5)
c.	BACK-UP	18	(42.9)	18	(42.9)	6	(14.3)
d.	RECOVERY	19	(45.2)	19	(45.2)	4	(9.5)
e.	TELEPROCESSING	10	(23.8)	16	(38.1)	16	(38.1)
f.	FILE HANDLING	6	(14.3)	26	(61.9)	10	(23.8)
g.	DB & NON-DB FILES	21	(51.2)	5	(12.2)	15	(36.6)
h.	PLANNING BACK-UP & RECOVERY	15	(35.7)	19	(45.2)	8	(19.0)

Figure 6.

DECISION TO GO DATA BASE

	YES		NO	
	n	%	n	%
a. WOULD YOU	44	(95.7)	2	(4.3)
b. SAME DBMS	29	(80.6)	7	(19.4)
c. ANOTHER DBMS	11	(34.4)	21	(65.6)
d. DEVELOP OWN DBMS	1	(2.4)	41	(97.6)

Figure 9.

	LIKELYHOOD OF FUTURE USE		IF NOT INTEGRATED YET, WHAT IS POSSIBILITY OF FUTURE INTEGRATION	
	n	%	n	%
1-NO POSSIBILITY	2	(4.3)	4	(15.4)
2-SOME POSSIBILITY	3	(6.4)	10	(38.5)
3-GOOD POSSIBILITY	6	(12.8)	6	(23.1)
4-VIRTUAL CERTAINTY	36	(76.6)	6	(23.1)
NO RESPONSE	0		21	
MEAN	3.62		2.54	

Figure 10.

The Videodisc: Implications for New Training, Sales & Storage Technology

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The commercial availability of videodisc technology has become a reality. Two major market place areas have been defined with at least four applications. The home or consumer market is projected to be one primarily of entertainment, while the industrial areas provide opportunities for training, sales and storage applications. This paper concentrates on the latter and describes the hardware and software considerations for each activity.

The Videodisc: Implications for New Training, Sales & Storage Technology

By

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Phoenix, Arizona

December 10, 1980

With such publication titles as "Videodiscs: A Three-Way Race for a Billion-Dollar Jackpot" and "Good-bye 'Dallas', Hello, Videodiscs" appearing respectively in Business Week and New York Magazine, the world's newest and somewhat controversial training and entertainment technology has at last arrived.

In 1925, the precursor of today's videodisc was in the laboratory. In the late twenties you could purchase one of John Baird's "television gramaphones" in a London department store. But, like many technologies, particularly in the areas of entertainment, education and training, this one too had gotten ahead of its time. But now it would appear that the videodisc is an idea whose time has finally come. The intent of this presentation is to briefly describe what has attracted the world's consumer-electronic giants, as well as others such as IBM, CBS, RCA, and MCA; where it is likely to have its greatest impact; and what factors are likely to control the rate of growth of videodisc technology.

In simple terms, the videodisc is a phonograph that plays pictures through a standard television set, the same device that has been watched for 15,000 hours by the average high school student by graduation. Somewhat like the phonograph, the videodisc comes in two basic formats, one referred to as the capacitance version; the second, as the optical equivalent.

Capacitance systems involve the reading of a grooved disc by a diamond stylus, the latter physically contacting the recorded surface. Optical systems in contrast involve no physical grooves or contact as a low intensity laser beam reads micropitted information from the disc. Within each of these major classifications there are minor variations which may lead in some cases to incompatibilities within a given classification.

It is the capacity and content of these discs to which the growing popularity of this technology must be attributed. Pictorial and audio information is contained on or beneath the twin surfaces of the classical videodisc. The capacity of a disc is best described in terms of the number of addressable slides which could be stored per disc side. Current technology permits that number to be as great as 54,000 stored on the equivalent number of tracks. Each videotrack is associated with two audio tracks. Systems permit the audio tracks to be played simultaneously, resulting in sterophonic sound or to be played separately, permitting a disc for example to be bilingual. Content is not limited to still frames. It may be a mixture of still and motion sequences. Where content is entirely made up of motion material, a two hour film can be recorded on a single videodisc.

The manner in which the content of a disc is projected through a standard television set or monitor is dependent upon the videodisc player involved. Players are generally classified into one of two categories, passive or interactive, sometimes referred to as consumer or industrial.

Both types provide the functions of still framing, slow motion forward and reverse, single stepping and rapid scanning, along with normal motion at thirty frames per second. The characteristic which serves as the primary identifier of the industrial or "intelligent" videodisc player is the presence of a microcomputer. The microprocessor permits programming of the industrial player, thus introducing a degree of interactivity not possible through the consumer units. For example, the initial portion of a recorded disc could be a table of contents, permitting the user to numerically select via a hand-held control unit the topic of his or her choice. Or, the designer of the disc content could have included self-evaluation questions of a multiple-choice format. Under control of the program stored within the microprocessor's memory, the disc player would "branch" to those parts of the videodisc related to the choices the user makes in answering the assessment questions.

Where the input and/or processing requirements exceed the capabilities of the internal micro, industrial players supply an interface through which an outboard computer can be attached. Through this extension of the basic industrial player, the users can do such things as answer constructed response questions through a conventional computer terminal keyboard, triggering pictorial reinforcement or remedial sequences, or they can do keyword searches on pictorial data bases.

The consumer unit, like that marketed by Magnavox, has as its primary use the playing of feature films. Its major market is the home and to a lesser extent, the library. In contrast, the interactive systems are primarily, but not exclusively targeted for applications and environments where passive use would far underutilize their capabilities and put them in a precarious competitive position with such media as videotape players and recorders. The remainder of this presentation will be limited to exploring what the interactive applications are, what the prerequisites are for their potential success and to examining some factors which will control the rate of market penetration.

Like the potential of similar film-based media, interactive videodisc technology appears to have its greatest long-range area of application in education and training. Because of the unchallenged findings of learning psychologists that interactive learning yields significantly better results than the passive equivalent, the intelligent videodisc would appear to have a future as a teaching aid.

One role that the disc can play is as a simple audio/visual extension of the classroom instructor, completely under his or her control, with little or no use of the self-contained microprocessor. Because of the disc's hugh mixed media capacity, the device can be used by the skilled instructor to gain a far greater degree of class participation than possible through conventional slide/tape or video cassette means. In this mode, the faculty or training staff member remains in complete control of the technology, a factor not to be underevaluated in the videodisc's gaining wide acceptance by the instructional staff.

By programming the microcomputer and through utilization of the numeric keyboard of an intelligent videodisc player, the device can be utilized in a pseudo computer assisted instruction mode. If the users are content to accept multiple-choice type inputs, the sytem can be used for pictorial test item data banks, drill exercises, and limited tutorial sequences.

Through linkage of the player to an external computer, a completely new deminsion is added to today's micro, mini and maxicomputer based CAI systems. Although instructional designers have long recognized that "a picture is worth a thousand words", virtually no computer based instructional system has been able to effectively and economically use this fact.

Attempts to use computer-generated graphics as pictorial substitutes or to integrate computer-controlled microfilm or slides have raised serious economical and/or operational questions. It would appear that the intelligent videodisc player can be added to operational CAI systems, exemplified by the attachment of players to the Apple microcomputer and the maxi-based, Controal Data PLATO system. When used as a peripheral pictorial device, this technology not only offers increased education and training function, but permits that function to be distributed and off-loaded , thus offering a means of significantly reducing instructional materials, storage and telecommunication costs. With the outboard computer power added and with current technology permitting a standard television screen to be used as a interactive display unit, it would appear that all facets of computer-based education and training can be significantly enhanced by videodisc.

Although education and training would appear to offer the greatest long-range potential for the videodisc, for reasons discussed below, this area may not offer the most immediate return on the disc manufacturer's investment. That return may rest on its use in sales promotion. No advertiser needs to be convinced on the value of pictures. With the television set becoming more evident in the operational sales environment and with the cost of live television commercials escalating to as high as $250,000 for 30 seconds on the recent "Who Shot JR" episode of Dallas, the videodisc offers some very interesting alternatives in product introduction, education and servicing.

Utilizing the extensive storage capacity of the disc for multiple product information storage and the dual sound track for consumer or merchandiser information, this technology offers a compact, simple to operate and easily distributed promotional medium. Evidence exists that the above is not mere theory, but has already in part been put into practice. General Motors dealerships throughout the contry already are populated with optical videodisc technology for constomer, sales and mechanic education. As the consumer player becomes more commonplace in the American home, the use of commerically available, product-oriented discs for the "do it yourself" type could become a reality.

Although videodiscs have yet to be extensively used for archival and other type storage, there is little question that as both the disc and television technology advance, this area of application will prove appealing. For storing data bases with high pictorial content this technology's capabilities are unexcelled. As a pictorial parts catalogue whose viability depends upon rapid access to any given element, the use has just begun.

In medicine and police science its applications are self evident. Where printed material constitute the data base, the current use is only limited by the size and density of the print and the resolution capabilities of the associated television technology.

If the applications of education and training, point of sales and storage were only dependent upon the disc and player technology, the extent of the use of "pictures on a phongraph" would be far beyond its present state. Regretfully for the disc advocate, this is not the case. Like most newly-introduced technologies in any field, there are a number of formidable inhibitors to the immediate widespread use of the disc. Among the primary challenges to the rapid penetration of the marketplace by the disc are competing technologies, disc content preparation and the relative inflexibility of many systems into which it could possibly be introduced.

The most formidable competitor of videodisc technology would appear to be videotape, particularly in the area of education and training. If the application requires frequent recording and playback, videotape must be the choice since for all practical purposes, the videodisc is a playback medium only. Where interactivity is of little or no value, the choice again may go to the tape, although consumer players do have advantages which should be seriously examined. However, where still framing, precise random accessing, mixed mode, fidelity and/or durability are important factors, videodisc would appear to be the likely choice. Like the comparable computer situation where access time is of significant importance - as is the use of the technology for interactive instruction- the choice of disc over tape is unquestioned.

However, the superiority of either technology becomes an academic issue if either the tape or the disc is blank. Courseware in the case of education and training applications or videoware in point of sales use present to some degree the same challenges encountered before in programmed test, traditional CAI or in corporate slide/tape promotional programs. Although modern computer-based authoring and production aids do facilitate the development of course and videoware, neither quality instructional and promotional materials nor creative uses of video-based technologies come without the investment of nontrivial amounts of time and dollars. Like the mythical fountain of youth, the much sought after "free lunch" in developing tape or disc content does not exist.

It has long been recognized that if a technology offers a solution to a non-existent problem within a system, that technology may never find entry to the system or if it does, its presence may be short-lived. In the area of home entertainment, Joseph Tushinsky of Superscope believes that the videodisc will create the biggest holocaust to ever hit the home unless new artforms are developed. If it does penetrate under these circumstances, it will be short-lived. If the technology does offer a solution to a training, sales or storage problem, but requires that the system be altered to address the problem, the technology may face an insurmountable difficulty. The videodisc technology of the 1980's presents no exception to these entry problems. It is the opinion of the author and others that the subject of this presentation adds extensive capability to computer-based as well as to more conventional audio/visual media. To exploit that capability will require not only changes in approaches and in organizational systems, but possibly in the technology itself. Those changes may require the combined efforts of vendors and potential users.

In conclusion, what appears to be the most powerful audio/visual technology yet developed has at last appeared. Like its predecessors, it could be ahead of its time. But with today's potential consumers being television literate and rapidly on the way to becoming computer conscious, the entry of the videodisc appears to be extremely well-timed.

TRACK IV
TREND AND MARKET ANALYSIS TO IMPACT ANALYSIS

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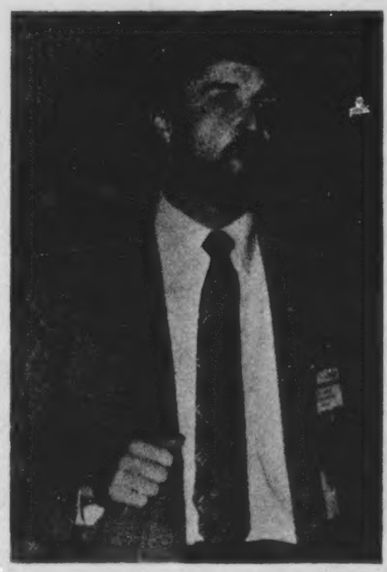

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NEW DIMENSIONS IN CONTINUING EDUCATION CAN PROVIDE SOME CONCEPTS FOR SURVIVAL IN THE 1980'S

by

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NEW DIMENSIONS IN CONTINUING EDUCATION CAN PROVIDE SOME CONCEPTS FOR SURVIVAL IN THE 1980'S

WHY IT IS NEEDED

What is an educational center? Some say it is a big box filled with equal-sized little boxes called classrooms or laboratories. They are conveniently arranged for the administration to establish groups of uniform size -- 25 if the community is rich, 35 if it is poor, and 50 if it doesn't care. In each box is placed a teacher who will be all things to students, all day, all year. Bells will ring to signal the musical chair game that is played half-a-dozen times a day as groups exchange boxes.

A flexible continuing education center with new dimensions can be the "change agent" for this rigid system. Continuing education is many times referred to as a separate segment of education. Yet by the very use of the word "continuing" it denotes that it is an integral part of the total educational spectrum and is a "continuous process." Education and life are synonymous, both formally and informally.

NEW DIMENSIONS

The following are some of the major new thrusts that have been and/or are being developed to be the "change agents" for continuing education.

Manpower Projections. The continuing education program, more than any other, is in a position to change gears and directions quickly as manpower projections change because of new variables and factors. Sometimes manpower projections change almost overnight. A good example of the manpower changing picture is the present surplus in teachers in many of the disciplines while several years ago critical shortages were evident and further shortages were predicted. Some manpower projection experts are now citing that within three years today's critical shortages in some health technology fields will become surpluses while today's surplus in the engineering technologies may become a critical area.

These variables in manpower projections have to be evaluated carefully by persons since the flexibility that can be so characteristic of continuing education offers the best solution to meeting these changes brought about by unseen variables.

Educational Media - Open Education. If formal education is to be the launching pad for a lifetime of learning, then a teacher's highest achievement will be to make his students independent of him. Why, then, shouldn't the student begin to learn at once, with schools and teachers harnessing the students natural curiosity and imagination and zest for mastery right from the start?

Independent study permits the student to develop, with occasional delight and sometimes frustration, his own power to seek out information, organize facts, master material, and generally accept responsibility for his own learning.

A name for a student's independent pursuits is investigation. No one can do it for the student. He must do it for himself. One of the places for independent study for nearly all students should be a comprehensive library-learning center. In fact, his carrel or station in the center can serve as the hub of each student school program during these years. Individually scheduled work on the common curriculum, as well as on individual projects, should be a central part of the students education. Electronic aids and programmed materials become critically important; and experts are equally essential to make these powerful tools work. The independent study can take place in the well-equipped laboratory on campus or working out in industry as the apprentice does. We could learn a lot from the apprentice journeyman approach to education. Other possible centers for independent study are in the neighborhood - yes, and even in taverns in order to take the educational program to the people. The use of portable cassettes, educational television, and instructional terminal education through a computerized system can all become important means to the open education concept. The MATC TV College of the Air served a new market of people who prefer to stay in their homes and take credit courses. A total of 873 students were enrolled in 4 courses offered this fall on television. A majority of these students are married women. Enrollment for the second semester for the College of the Air at MATC increased to 1,265 individuals. Reaction to the new TV High School Series, Your Future is Now, has been gratifying with 225 students enrolled. This course offers an opportunity for those who have not completed high school to satisfy high school requirements and receive a GED diploma. In order to give a better picture of the special "open education" concept in the Milwaukee Area Technical College, it has been presented in Appendix A of this article.

Community Resources - Delegate Agencies. Even with all of the special activities and programs that are being utilized by the institutions in the "open education" concept, there is still a large segment of disadvantaged population that we cannot reach. For this we depend on an agency relationship with other community organizations who can reach them and "get them ready" for our institutional setting. This we call "open education" by agencies "without" the institutional setting. It is our feeling, based on fact, that there are certain things that the agency can do which we cannot. For example, they can go into the local communities, talk with the families, recruit the students, and give them the basic training which is essential for employment at a later stage.

Basically, the point is: The program was started through an agency which existed in the community with which they were familiar, and in which they had confidence. These programs have been very successful. The agencies of the community we are working with in this capacity are in Appendix B.

In order to help the Milwaukee Area Technical College and the community in the coordination of these agencies, a coordinating organization was formed, known as the Community Relations-Social Development Commission.

This is a brief analysis of various methods and techniques used at the Milwaukee Area Technical College in cooperation with other community agencies to promote the "open education" concept. We cannot claim, nor do we believe that we are capable of, 100 percent success in this effort. There are too many diversionary forces at work with the students, but we feel that our success -- a successful completion of the program -- is achieved with from 50 to 85 percent of the student population. The great majority of the students trained are disadvantaged in one way or another. The percent of placement in jobs after completion is significantly high. Our special "open education" concept in Milwaukee is not the panacea but is one case method that has met with some success.

The Learning Process. We cannot meet the learning process needs of the future with the traditional or conventional method. Say education to almost anyone, and you conjure up the mental picture of a rectangular room that encloses a teacher facing approximately 30 students. It is hard to think up many significant occasions when people group themselves in this way outside of education. In business or the profession, people work alone; or they talk things over with somebody else; or they confer in groups of three or four, up to a dozen or so; or they join large audiences -- numbering hundreds, sometimes more -- for exposition or demonstration. One innovative means of permitting the student to develop on his own power, to seek out information, organize facts, master material, and accept his responsibility is through independent study.

The second learning process is dialogue. Mankind has accepted as an ideal mode of instruction the great teacher in discourse with a single student such as Aristotle with Alexander, Johnson with Boswell, Ann Sullivan with Helen Keller, and others. A third method within the learning process is the seminar or small-group discussion. A small group is primarily useful for interaction, controversy, debate, side-taking, and opinion-forming. A fourth innovative method in the learning process is the large group presentation. It is usually pure one-way communication. This can be done personally or through televised courses, tapes, international telecommunications via the satellite or other technological devices. The use of large groups, wherever appropriate, releases that much teacher and student time for independent study, dialogue, or for study in small group seminars.

It might be better to produce both a better institution for continuing education and an institution that would be a leadership force in the regeneration and revival of the total community. This could happen not only through the education of people but also through a new approach to the planning operation of the educational facilities. Facilities could become an integral part of, and a contribution to, the renewal of the community. Some examples of this are:

1. A multi-purpose facility which could be used to incorporate the spirit of change and suggestions given above to improve the learning in a self-renewing concept. This facility would be used by business, labor, and industry for their needed activities such as apprentice education, trade shows, interchange of employees, and interchange of facilities for better utilization and less duplication. The facility would offer an opportunity to the other community activities. It would be used 52 weeks a year, seven days per week and 24 hours per day.

2. Converted surplus properties offer excellent opportunities for rehabilitation for continuing education centers. Many recent studies through the Educational Facilities Laboratory of the Ford Foundation have demonstrated that the hypothesis that it is cheaper and better to build new than to rehabilitate is erroneous.

3. In order to promote the multi-purpose facility concept and to work as a leadership force in the community to promote industrial and business development, the industrial park example has great merit because the educational center has the advantages of the nearby industries for cooperative programs and job placement. The industries have the advantage of their built-in skilled help.

4. Each of the 50 states conduct state and local fairs. Acreage and facilities are set aside for these. It is my contention that a vocational-technical facility with continuing education can be planned with other community activities in order to make these a year-round operation. It is somewhat of an expensive item when the facilities are utilized, in many cases, only two to three weeks per year.

5. The construction of continuing educational facilities committed to meeting the needs of the central city are very important for the progress of this country. This commitment can be assured and achieved through its being incorporated in the overall plan for the face-lifting and restoration of the deteriorated part of the city.

6. In the planning of the continuing education facility, the building-in of a conversion factor is very important. This offers the district the opportunity to give up the facility for another purpose and yet be able to recoup its capital investment.

Teacher Source. The resources for personnel to staff the continuing education centers have come primarily from business and industry for this educational field. The need for a combination of business and industrial experience in education is vital, but scarce. A person from the actual trade area who is hired for the teaching position many times lacks the knowledge and understanding of the growth and development of human beings as well as the motivation aspects of learning. On the other hand, the educator lacks the knowledge and experience in the trade area. A combination is the answer. Therefore, we take people from the trades and train them in the educational aspects. Now, we need to do more of taking of educators and giving them the trade experience. Another important resource for the improvement of the continuing education program is the teacher after we hire him. We must supply him with in-service educational opportunities in order for him to keep abreast of the changes in the business and industrial world. One of the best means for doing this is to create an exhange program with business and industry whereby their people come in to the continuing education center in order to teach, counsel and to help administer it. On the other hand, the educator can go into industry and spend some time helping business and industry to achieve their goals and objectives and to learn their procedures, policies, and practices in the actual progress of the industry within the business world. A close working relationship with business, industry, and the continuing education center must continue to develop in order that an in-service program for better understanding of education as it relates to the community can take place.

Program and Student Options. A new dimension in the continuing education programs must permit the student the options to enter-leave-enter-leave-whatever is necessary to meet the needs of the students. The student may need to go to school for awhile, work awhile, do a combination of both for awhile, enter the military service for awhile, attend another educational institution, transfer back to our continuing education center -- all of this must be provided in a flexible continuing educational program. This program should not have any of today's rigidity of related major and minor sequence. In addition, a number of the disciplines or specialities will be changing. For this reason, a broad disciplinary training program for the flexibility of the technical changes must be part of continuing education. The student will have to become involved in cross-disciplinary approaches to his or her job. In this, the student will become the vital component and support of some rather untraditional areas of work with which we are presently experimenting such as biomedical engineering, biospace engineering, human factors engineering, electro-mechanical engineering, pharmaceutical-psychological engineering, ethical and human value technology -- and who knows what else the future may require? The person receiving these types of cross-disciplinary approaches will have a tremendous amount of specialization but will also have an approach that is broadening because the specialist will have to have this broadened approach whereby he can move flexibly with his particular skill or technical area as it changes from day-to-day and month-to-month. When the applicant enters the continuing education center, a flexible approach in regard to his present body of knowledge will have to be evaluated. Advanced standing can be measured upon evaluation of his past program such as in apprentice education, trade exams, etc. He can transfer credits from other colleges or universities. His previous work experience and education can be evaluated. An evaluation of his studies carried on as part of civil or military training programs can be duly certified. General knowledge exams can be given in order to permit the student to move at his own pace, skill, and speed. To meet these program and student option objectives, there must be a comprehensive continuing education program in an institution with a flexible curriculum and with excellent guidance and counseling.

Special Community Services. In the past year our school had 374 community service sessions with an attendance of 94,851 persons gathering knowledge from 453 speakers from all over the United States. It was our privilege to work with 117 cooperating organizations who assisted us in having the largest number of community service programs in the history of our school. These special seminars covered a diversified list of topics from freeway driving, drug abuse, sales clinics, wig selection and care, to "How to complete your income tax." They were held in more than fifty-four different locations throughout the community.

Supervision, Evaluation and Accountability. A new "in" word has arrived on the educational scene to replace tired, overworked "relevance." It is "accountability" - a term used to describe a process and a concept which could revolutionize the nation's schools by the end of the 1980's.

Supervision and evaluation are in reality segments of the total concept of accountability in education. Good supervision and evaluation are means or techniques to reveal our accountability. They are really a part of the performance contracting as a response to accountability in education.

Accountability can mean many things . The dictionary definition is "responsibility." In education, or at least to those who are leading the accountability movement, it means something specific: Decide what it is you are going to do. Do it. Then prove you've done it. This is the procedure that we are going to have to use to supervise, evaluate and account for our continuing education programs in the future.

SUMMARY

God created all living things on the earth -- but human beings were created with more imagination, creativity, and innovative minds. Are we going to use this creative thinking in establishing and implementing new dimensions for a changing world? Are we going to plan for the changes of the future, or will things just change regardless of us? These are the questions we must answer as we consider those new dimensions in continuing education which I have presented.

APPENDIX A

I. Special Activities and Programs

1. Southern Wisconsin Television High School.
2. Southern Wisconsin Television College.
3. Commando I Project to encourage parolees to complete Continuation Education.
4. Program Employability.
5. Sensitivity Training for teaching and recruiting the disadvantaged.
6. "Crossover," a special exploratory program in pre-vocational and technical programs for high-risk graduates from the inner core, north and south.
7. Recruitment and orientation of disadvantaged applicants for admission into the community service aide program.
8. House-to-house summer recruitment program.

II. Special Programs for Motivation and Stimulus

1. Continuing education for high school dropouts.
2. Total systems approach for reading for disadvantaged youth.
3. Dental laboratory in a closed circuit television system.
4. Utilizing training films in qualifying welding certification candidates.
5. Linguistic competence through an oral, structural approach.
6. Audio-visual tutorial teaching system for youth in college basic speech courses.
7. A programmed auto-tutorial approach to Chemistry I and II.
8. Audio-visual tutorial program in business mathematics.
9. Nursing Skills in a learning laboratory.
10. Auto-tutorial approach to Biological Sciences.
11. Budget power.
12. Program for consumer education of the handicapped, disadvantaged population.
13. Food Service Training Program.
14. Reading Workshop for Adults.
15. English as a Second Language.
16. Basic Education and Eighth Grade Diploma Program for Adults.
17. General Education Developmental Program.
18. Providing the General Education Development laboratory for high school equivalency training.
19. Remedial arithmetic course for disadvantaged associate degree nursing applicants and students.
20. Understanding Human Behavior preparatory course in the Health Occupations.
21. Reading Improvement preparatory course in the Practical Nurse Program.
22. Personal Money Management.
23. Civil Service examination review.
24. Evening Continuing Education.
25. Developmental programs for all technologies.
26. Adult High School Diploma for Disadvantaged Persons in Vocational Training.
27. Individualized Counseling--Teaching Adults with Learning Difficulties.

28. Home Management Series for the AFDC Mothers and Non-Welfare Poor.
29. Home Management for Unwed Mothers.
30. Special education programs for socially maladjusted and handicapped.
31. Preparatory program for industrial or apprentice programs.
32. Preparatory program for construction trades programs.
33. Consumer Emphasis in Adult Programs.
34. TV workshop for disadvantaged youth as pre-vocational training.
35. Maintenance Training.
36. Family Living Education for disadvantaged adults.
37. Computerized Guidance.

APPENDIX B

1. The Opportunity Industrializations Center was conceived and operates to involve persons of varied economic and vocational levels in an escalating remedial - pre-vocational process.
2. El Centro Espanol was established to meet the peculiar problems of the Spanish-speaking community and to serve as a base for improving the social and economic status of the group.
3. Concentrated Employment Project represents the major manpower development thrust of the United States Department of Labor.
4. The University of the Streets beams its efforts toward high school dropouts and young persons who are parolees.
5. New Careers seeks to stimulate upward mobility particularly among employed persons who now function in paraprofessional roles.
6. Transitional School was developed out of the realization that thousands of high school graduates could not qualify for college entrance based upon the traditional entrance requirements.
7. Harambee House was established for youth who are parolees and have need for intensive guidance and counseling.
8. The Urban League was created to assist blacks who come from the rural south to adjust to northern city life.
9. The Jewish Vocational Service concentrates on testing - re-testing and frequent psychological contacts.
10. The JOBS Program operates as a relationship between the National Alliance of Businessmen and the U. S. Department of Labor. It is for the hard-core unemployed.
11. Goodwill Industries, Inc. provides the handicapped with the opportunity to engage in meaningful and productive operation.
12. Northcott Neighborhood House operates on the settlement house concept. It has been especially successful in discovering indigenous leadership and in providing leadership training.

GETTING AT THE FACTORS UNDERLYING TRENDS USING STATISTICAL DECOMPOSITION TECHNIQUES

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Abstract

Trends are typically expressed in terms of absolute or percentage values, e.g., "enrollment increased by 10 percent last year." Although descriptors such as these are easily calculated and interpreted, they say nothing about the component's underlying trends. This paper presents a powerful, yet easily-used technique, that offers a quantitative approach for doing this. This technique, which has not found routine application to educational data, is drawn from the areas of statistical decomposition analysis and information theory, and offers easy-to-interpret results. It can be applied at various levels within the educational environment, ranging from departments to entire college systems. The method is formally described and explained with the help of an example. Following this, data relating to community colleges in Washington State are used to illustrate how the technique quantifies the effects of internal and external influences on enrollment trends and staffing patterns. This illustrative analysis leads to a discussion of how these influences, once identified and measured, can be used to analyze changes in institutional practices.

INTRODUCTION

The idea for this paper grew out of a practical need. This past year our board was engaged in a comprehensive review and analysis of the status of the community college system. A substantial amount of statistical information was compiled as a part of the study and, naturally, one item was the increased participation rate in community college programs by the citizens of the state. Of particular interest were the factors that had contributed to the increase. Although a quick examination of the "raw" figures on female enrollment, part-time enrollment, etc., provided fair general indications, we wanted to present the information in a way that quantitatively expressed the amount of the increase that was attributable to the various contributing factors. We reviewed the statistical techniques available for doing this, including those based on regression analysis, log-linear analysis, information theory, and descriptive statistics. We chose the descriptive statistical approach--primarily because of its ease of application and also the concepts and results are relatively easy to explain.

In this paper we are going to discuss this approach to analyzing components underlying differences or changes in rates. First, the technique will be formally defined using some mathematical notation. Example applications using actual data will then be used to illustrate how this technique quantifies the effects of various factors on changes and differences as follows:

1. Changes in the overall state community college participation rate over time;

2. Differences in participation rates between two community college service areas; and,

3. Changes in faculty/student ratios at a specific college over time.

Following the third example is a more detailed discussion of the interpretation and analysis of the results obtained through application of the techniques.

FORMAL DESCRIPTION OF DECOMPOSITION TECHNIQUE

Definitions

Consider any rate (or more generally a ratio) where $R = P_1/P_2$.

Where P_1 = a collection of N_1 items representing set P_1

P_2 = a collection of N_2 items representing set P_2.

If there are $i = 1$ through K categories into which P_2 can be classified for which there is an associated category-specific rate, $r_i = P_{1i}/P_{2i}$, then R can be written as a weighted sum of the category specific rates, where each weight is the proportion of P_2 items in category i.

$$R = \sum_{i=1}^{K} \left(\frac{P_{2i}}{P_2}\right)\left(\frac{P_{1i}}{P_{2i}}\right) = \sum p_i r_i \qquad [1]$$

Equation [1] implies that a change in R, between time = x and time = x+y, can be written as

$$R_{x+y} - R_x = (\sum p_i r_i)_{x+y} - (\sum p_i r_i)_x \qquad [2]$$

Equation [2], in turn can be manipulated so that principal terms, representing the contribution of the components of change in R, can be isolated. This manipulation, which is the key to understanding this approach to decomposition analysis, can be illustrated with the following example.

$$\sum p_i r_i = (p_1 r_1 + p_2 r_2)$$

and a change in R could be written as

$$(\sum p_i r_i)_{x+y} - (\sum p_i r_i)_x = (p_1 r_1 + p_2 r_2)_{x+y} - (p_1 r_1 + p_2 r_2)_y \qquad [3]$$

which is algebraically equivalent to writing

$$(p_1 r_1 + P_2 r_2)_x + y - (p_1 r_1 + p_2 r_2)_x =$$

$$\left[\left[\frac{r_{1x+y} + r_{1x}}{2}\right](P_{1x+y} - P_{1x}) + \left[\frac{r_{2x+y} + r_{2x}}{2}\right](P_{2x+y} - P_{2x})\right] + \qquad [4]$$
$$\left[\left[\frac{P_{1x+y} + P_{1x}}{2}\right](r_{1x+y} - r_{1x}) + \left[\frac{P_{2x+y} + P_{2x}}{2}\right](r_{2x+y} - r_{2x})\right]$$

(See footnote 1 for a complete proof.)

Notice that there are two principal terms in the righthand side of Equation [4]. The first term gives the contribution of structural change in Factor P to the change in R while the second term gives the contribution of the category-specific rates, r_1 and r_2, to the change in R. Notice, further, that in the first term the "mean" values of r_1 and r_2 are taken over times x+y and x and multiplied by the differences (subtraction) for P_1 and P_2 between time x+y and x, respectively. In the second term, the "mean" values of P_1 and P_2 are multiplied by the difference in r_1 and r_2, respectively. This is the convention that gives the contribution of one factor--by taking its difference--while multiplying it against a "constant value" of the other factor--its mean value. Since this algebraic sleight-of-hand still sums to the original change in R, it provides a way to assess the contribution of each factor. This approach can, of course, be extended to include both more categories and more variables and in the formal definition given below, a three variable, multi-categorical decomposition is defined.

$$\Delta R = \sum_{i}^{k} \bar{r}_i \Delta p_i + \sum_{i}^{k}\sum_{j}^{m} \bar{p}_i \bar{r}_{ij} \Delta p_{ij} + \sum_{i}^{k}\sum_{j}^{m} \bar{p}_i \bar{p}_{ij} \Delta r_{ij} \qquad [5]$$

Where $\bar{r}_i$, $\bar{P}_i$, $\bar{r}_{ij}$, and $\bar{p}_{ij}$ are averages and Δp_{ij}, Δp_{ij} and Δr_{ij} are differences, with p and r referring to a set of category-specific structural variables and category-specific ratios, respectively.

Equation [5] gives contributions to a difference (or change) in ratios from three effects, where each of its three terms refers to an effect. The first term gives the contribution of a difference in structural Factor I; the second term gives the contribution of differences in Factor J within Factor I; and the third term gives the contribution from changes in I-J specific ratios.

This three-term form will be used throughout the remainder of this paper.

SOME CHARACTERISTICS OF THE TECHNIQUE

This technique has, of course, some characteristics that make it less than ideal for component analysis. An important one is that the order in which variables are introduced affects the outcome. For example, if age is used as a primary structural factor and sex (by age) is a secondary structural factor, the effects of age and sex (by age) will be different than the effects of sex and age (by sex) for the same data, where sex is the primary structural factor and age (by sex) is the secondary. Another point is that the distinction between the contributions of structure and category-specific rates is not without ambiguity. Structural effects depend not only on differences but also on the mean values of the category-specific rates, which, in turn, are determined by differences in these rates. Similarly, the effects of category-specific rates depend not only on differences between rates but also on the mean values of the structural effects, which, in turn, are determined by differences in these effects.

THREE EXAMPLE APPLICATIONS

Example 1: Changes in the overall state community college participation rate over time.

The first example is an age-sex decomposition of the change in the total community college participation rate (Fall headcount enrollment/total state population) for Washington between 1971 and 1979.

COMMUNITY COLLEGE
PARTICIPATION RATE (per 1000 persons)

Year	Rate
1979	49.71
1971	30.42

Change = 49.71 - 30.42 - 19.29

Components of Change (in percent)

Contribution from change in:

(1) State population's sex-structure: - 1.30

(2) State population's age-structure by sex: 13.70

(3) State participation rate structure: 88.13

Females (69.52)
Age 15-29 26.39
Age 30+ 42.46

Thus, we find that the net effect of changes in the state population's age-sex structure contributed to about 12 percent of the total change in the participation rate; while about 88 percent of the change can be attributed to increased participation. (That is, while holding constant the participation rate effects, demographic effects contributed about 12 percent; whle holding constant demographic effects, participation rate effects contributed about 88 percent.) Further, the increased participation rate of females, age 30 years and over, itself contributed to nearly 43 percent of the total change.

Example 2: Differences in participation rates between two community college service areas.

The second example uses Fall, 1979, participation rates from two areas within Washington state. In Eastern Washington, the community college participation rate was 57.38 (per 1000), while in the City of Seattle, it was only 54.91 (per 1000).

PERCENT DECOMPOSITION OF THE DIFFERENCE
IN TOTAL COMMUNITY COLLEGE PARTICIPATION RATE
BETWEEN EASTERN WASHINGTON AND SEATTLE

CONTRIBUTION FROM DIFFERENCE IN:

AGE STRUCTURE

All Ages	15-19	20-29	30+
26.50	0.10	42.70	-16.30

SEX-STRUCTURE BY AGE

Age	Both Sexes	Male	Female
15-19	-0.01	6.739	-6.748
20-29	0.130	-5.065	5.195
30+	-0.45	1.753	-2.203
All Ages	-0.33		

AGE-SEX PARTICIPATION RATES

Age	Both Sexes	Male	Female
15-19	187.70	80.30	107.40
20-29	-151.20	-108.20	- 43.00
30+	37.40	50.60	88.00
All Ages	73.90		

DATA UNDERLYING EXAMPLE 2

PROPORTION OF POPULATION BY AGE GROUP

Age	E. Washington	Seattle
15-19	.12859	.12852
20-29	.25990	.24926
30+	.61151	.62221

PROPORTION OF AGE GROUP THAT IS MALE

15-19	.52112	.49966
20-29	.51541	.52043
30+	.48409	.46290

PROPORTION OF AGE GROUP THAT IS FEMALE

15-19	.47888	.50034
20-29	.43459	.47957
30+	.51591	.53710

PARTICIPATION RATES (Both Sexes)

15-19	.07335	.04227
20-29	.09182	.10641
30+	.03820	.03689

PARTICIPATION RATES (Males)

15-19	.07545	.04522
20-29	.08775	.10802
30+	.03098	.03526

PARTICIPATION RATES (Females)

15-19	.08149	.03933
20-29	.09614	.10467
30+	.04498	.03829

This example shows that about one-fourth of the contribution to the higher participation rate found in Eastern Washington relative to Seattle is from differences in the age-structure: Eastern Washington has a higher proportion of people age 20-29, an age group with the highest participation rates. Within the contribution from participation rates, note that Seattle has higher rates for the age group 20-29, which provides strong negative effects. (That is, holding other factors constant, these effects contributed to a higher overall rate for Seattle.) However, the higher rates in Eastern Washington for age groups 15-19 and 30+ more than wiped out Seattle's advantage in the 20-29 age group.

Example 3: Changes in faculty/student ratios at a specific college over time

From 1978-79 to 1979-80, the ratio of faculty to students (FTE-F/FTE-S) declined from 18.46 to 17.23 at a Washington community college. This decline indicates that the college's staffing level in 1979-80 increased relative to its enrollment level.

We would like to know what has contributed to this decline. Accordingly, we will look at three major factors:

I. Shift in enrollment (FTEs) by time/location of courses

   A. Day-on-campus

   B. All other

II. Shift in enrollment (FTEs) by institutional intent of courses (within time/location categories)

   A. Academic

   B. Vocational

III. Shift in staffing by

   A. Day-on-campus

   B. All other

   C. Academic

   D. Vocational

These numbers show changes when controlling further effects of changes in other areas.

	ALL TIME/ LOCATION CATEGORIES	DAY-ON CAMPUS	NON-DAY-ON-CAMPUS
CONTRIBUTION FROM CHANGE IN:			
I. TIME/LOCATION FTES	+ 5.70	+18.14	-12.44
II. INSTITUTIONAL INTENT FTES			
A. Academic	+16.06	+54.66	+38.60
B. Vocational	+39.64	+70.73	-31.09
III. TIME/LOCATION - INTENT Specific FTE-F/FTE-S Ratio:			
A. Academic	+16.88	45.08	-28.20
B. Vocational	53.63	34.72	+18.91
TOTAL**	99.79	114.01	-14.22

**Total does not equal 100.00 because of rounding error.

DATA UNDERLYING EXAMPLE 3

	FTE-S	FTE-F	$\frac{\text{FTE-F}}{\text{FTE-S}}$
1978-79			
Day-On-Campus:			
Academic	289.17	21.20	.05447
Vocational	284.19	20.33	.07154
TOTAL	673.36	41.53	.06168
Non-Day-On-Campus:			
Academic	148.62	8.17	.05497
Vocational	362.17	14.45	.03990
TOTAL	510.79	22.62	.04428
GRAND TOTAL	1,184.15	64.15	.05417
1979-80			
Day-On-Campus:			
Academic	359.15	21.56	.06003
Vocational	339.99	26.07	.07668
TOTAL	699.14	47.63	.06813
Non-Day-On-Campus:			
Academic	182.34	8.59	.04711
Vocational	325.01	13.79	.04243
TOTAL	507.35	22.38	.04411
GRAND TOTAL	1,206.49	70.01	.05803

ANALYSIS OF EXAMPLE 3 RESULTS

In 1978-79, 56.86 percent of all FTE-students were comprised of day-on-campus FTE-students. In 1979-80, this increased to 57.95 percent.

In 1978-79, 57.80 percent of the day-on-campus FTE-students were academic; in 1979-80 this declined to 51.37 percent.

In 1978-79, only 29.10 percent of non-day-on-campus FTE-students were academic; by 1979-80, this share increased to 35.94 percent.

The day-on-campus increase between 1978-79 and 1979-80 was primarily due to increased vocational FTE-students, some of which also shifted from the evening and off-campus programs.

This decomposition of enrollment growth can then be helpful when looking at the overall ratio of faculty to students. When the strongest contributing factor to enrollment growth is an increase in the day-on-campus vocational program area, which by nature has fewer students per instructor, is accompanied by a decline in the academic area, it follows that the overall ratio of faculty to students will go up. Having a broader base of background information such as this provides for more interpretations than the quick conclusion that a higher faculty to student ratio implies a reduction in efficiency.

CLOSING COMMENTS

The examples cited are illustrative of how the decomposition technique can be used for analyzing differences over time between any two units--service areas, colleges, departments, and the like. In addition, the technique can be applied in an iterative fashion. For example, in the case of Faculty/Student ratios, the change in the ratio for day-on-campus academic programs can, itself, be decomposed by department, full-time/part-time instructor status, and so on.

BIBLIOGRAPHY

KITAGAWA, E.

1955 "Components of A Difference Between Two Rates." Journal of The American Statistical Association, 50 (December): 1168-1194

RETHERFORD, R. and L. J. Cho

1974 "Comparative Analysis of Recent Fertility Trends in East Asia." East-West Population Institute (Honolulu) Reprint No. 51.

FOOTNOTE 1

The easiest way to show this equivalency is to work backwards.

$$[[\frac{r_{1x+y} + r_{1x}}{2}](P_{1x+y} - P_{1x}) + [\frac{r_{2x+y} + r_{2y}}{2}](P_{2x+y} - P_{2x})]$$

$$+ [[\frac{P1_{x+y} + P_{1x}}{2}](r_{1x+y} - r_{1y}) + [\frac{P_{2x+y} + P_{2y}}{2}](r_{2x+y} - r_{2x})]$$

$$= (.5)[r_{1x+y} + r_{1x}](P_{1x+y} - P_{1x}) + (.5)]r_{2x+y} + r_{2x}](P2_{x+y} - P_{2x})$$

$$+ (.5)[P^{1x+y} + p^{1x}](r_{1x+y} - r_{1x}) + (.5)[P_{2x+y} + P_{2x}](r_{2x+y} - r_{2x})$$

Carry out some multiplication, we find that

$$(.5)[[(r_{1x+y})(P_{1x+y}) + (r_{1x})(P_{1x+y}) - (r_{1x+y})(P_{1x}) - (r_{1x})(P_{1x})]$$

$$+ [(r_{2x+y})(P_{2x+y}) + (r_{2x})(P_{2x+y}) - (r_{2x+y})(P_{2x}) - (r_{2x})(P_{2x})]$$

$$+ [(P_{1x+y})(r_{1x+y}) + (P_{1x})(r_{1x+y}) - (P_{1x+y})(r_{1x}) - (P_{1x})(r_{1x})]$$

$$+ [(P_{2x+y})(r_{2x+y}) + (P_{2x})(r_{2x+y}) - (P_{2x+y})(r_{2x}) - (P_{2x})(r_{2x})]]$$

Now, by rearranging the interior terms, some cancellations become apparent:

$$(.5)[(r_{1x+y})(P_{1x+y}) + (r_{1x+y})(P_{1x+y}) - (r_{1x})(P_{1x}) - (r_{2x})(P_{1x})$$

$$+ (r_{1x})(P_{1x+y}) - (P_{1x+y})(r_{1x}) - (r_{1x+y})(P_{1x}) + (P_{1x})(r_{1x+y})$$

$$+ (r_{2x+y})(P_{2x+y}) + (P_{2x+y})(r_{2x+y}) - (r_{2x})(P_{2x}) - (P_{2x})(r_{2x})$$

$$+ (r_{2x})(P_{2x+y}) - (P_{2x+y})(r_{2x}) - (r_{2x+y})(P_{2x}) + (P_{2x})(r_{2x+y})]$$

which, following the preceding cancellations, leaves

$$(.5)[(2)(r_{1x+y})(P_{1x+y}) + (2)(r_{2x+y})(P_{2x+y}) - (2)(r_{1x})(P_{1x}) - (2)(r_{2x})(P_{2x})]$$

which reduces to

$$[(r_{1x+y})(P_{1x+y}) + (r_{2x+y})(P_{2x+y})] - [(r_{1x})(P_{1x}) + (r_{2x})(P_{2x})]$$

which equals

$$(\sum p_i r_i)_{x+y} - (\sum p_i r_i)_x$$

INVESTMENT IN VERTICAL INFORMATION SYSTEMS AS A PREVAILING STRATEGY FOR DEALING WITH TASK UNCERTAINTY IN HIGHER EDUCATION

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Requests by external agencies for information about many facets of institutional operations and resources may be viewed as uncertainty regarding external perception of tasks performed in higher education. What is being done by whom, for whom, and how? The complexity of higher education functions and societal demands make these questions difficult to answer quickly and simply. Galbraith posited that the amount of information needed to perform (describe) a task is a function of the diversity of outputs, of the different input resources utilized, and of the level of goal difficulty. The greater the uncertainty of the task, the greater the amount of information that has to be processed between decision makers. One of four available strategies is investment in vertical information systems (in higher education, those extending from the operational level to top administrative levels and thence to state and federal levels). This study analyzes and describes: (1) reasons for task uncertainty in higher education; (2) how selection of vertical information systems came about as a strategy; and (3) limitations in the apparent success, to date, with vertical information systems. Recommendations are offered for dealing with the present state-of-the-art.

INVESTMENT IN VERTICAL INFORMATION SYSTEMS AS A PREVAILING STRATEGY FOR DEALING WITH TASK UNCERTAINTY IN HIGHER EDUCATION

INTRODUCTION

Creation and use of organized management information in higher education has increased significantly over the past twenty-five years. What began as a thrust toward self-study for improved operations and internal management evolved through a planning and growth phase into heightened involvement with and response to state legislative concerns with the activities and costs of higher education in a time of financial stress. Demands presently tend to exist for more information about more facets of institutional operations and functions, processes and outputs.

Given the complexity of functions, the range of societal demands placed upon higher education, and--particularly at major research universities--interdisciplinary activities and extensive relationships with outside agents, it should have come as no surprise that external requests have been made for more information. In addition to budgeting and funding documentation, many of these requests seek to clarify tasks performed by postsecondary institutions. Greater information is sought to reduce externally perceived uncertainty about tasks in higher education.

Examination of ways for dealing with task uncertainty in higher education, including the role of organizational information systems, is useful because it offers a broader perspective on state agency requests for information; offers an opportunity to help clarify limitations, and expectations of how institutional information systems tend to function in providing information at top executive and external levels; suggests that sufficient attention should be devoted to the role of information analysis functions in designing and/or modifying institutional information systems and helps draw implications for college and university systems in the 1980's.

This particular examination focuses on:

- Kinds of organizational uncertainty.
- Information and organizational uncertainty.
- The nature of higher education and institutional information systems.
- Reasons for task uncertainty in higher education and the potential distance between "perceived" versus "actual" organizational tasks.
- External requests for institutional information.
- Organizational strategies for dealing with task uncertainty.
- Investment in vertical information systems as a strategy for dealing with task uncertainty.
- Reasons for limited success, to date, of vertical information systems.
- The present dilemma.
- Recommendations for coping with the state-of-the-art of vertical information systems and task uncertainty.

Selected highlights are used to present and portray the main topic, noting that this is only one of several approaches for examining the topic.

KINDS OF ORGANIZATIONAL UNCERTAINTY

Little commonality exists among researchers or theorists regarding the precise meaning of organizational uncertainty or ways to measure it (Gifford, Bobbitt, and Slocum). Definitions and measures may involve information load (amount, sources, timeliness, feedback, sufficiency, and outcomes) and patterns versus randomness (change, variance, cues, clarity, frequency, probability, freedom of choice, and causal relationships). Uncertainty may be objective, involving messages surrounding a decision, or may be perceived, involving characteristics of the decision maker.

In simpler terms, organizational uncertainty concerns what is happening, who is involved, when, where, how, and why. It can concern internal inputs, processes, and outputs and/or certain external events related to the organization. It can involve analyzing the present or predicting future circumstances. It can treat few or many variables, at aggregated or disaggregated levels. It can concern lack of facts or, given the necessary facts, doubt as to which decision to make. Also, given the facts, uncertainty can stem from a lack of understanding or from disbelief as to the truth or validity of the information. Uncertainty about tasks may occur only at certain organizational levels.

Of the various kinds of uncertainty, this study focuses on task uncertainty in higher education, particularly in terms of tasks performed within a given institution. Task uncertainty is defined as the difference between the amount of input-output-goal information required to perform a task and the amount of such information already possessed by the organization. (For instance, what are the task relationships between research and instruction in academic unit X? How do students majoring in discipline Y utilize the library collection? Is the average faculty teaching load for the discipline or institution high, low, or about right? And so on.)

INFORMATION AND ORGANIZATIONAL UNCERTAINTY

Information and uncertainty are said to be complementary (Arrow). They are also viewed as positive and negative. Uncertainty is the gap between what is known and what needs to be known. Furthermore, as pointed out by Mack:

> Dealing sensibly with uncertainty is not a byway on the road to responsible business and governmental decision. It is central to it. The subject is complex, elusive, and omnipresent.

What makes the provision of sufficient information to close the gap between known and unknown complex and elusive? Putting aside such matters as which decision to make, whether understanding occurs, whether one is persuaded to believe and accept information, difficulties of predicting future likelihoods, and given that organizational information is typically a highly reduced and abstracted reflection of behavior, closing the organizational information gap is complex because of the following competing, conflicting, and/or overlapping factors:

- organizational goals and purposes
- levels and types of organizational tasks
- quantitative versus qualitative behavior
- diverse and changing criteria for defining and creating data } for
- diverse and changing criteria for interpreting and attaching } what meaning to data } purpose?
- the difficulty of capturing the how and why of whatever was done
- comparisons with what?
- the limited nature of systematized organizational information systems

- identification and change of the purpose of data
- the high cost of capturing and reporting information in times of decreasing real dollars, i.e., limited resources

Focusing on task uncertainty in higher education, a brief synopsis of the nature of higher education and of institutional information systems is essential and provides an opportunity to examine the forementioned complex and overlapping factors.

THE NATURE OF HIGHER EDUCATION AND INSTITUTIONAL INFORMATION SYSTEMS

The following synopsis presents two views of higher education and institutional information systems because both are relevant to the topic. The first view provides a broader context; the second considers those factors more closely related to vertical information systems and task uncertainty.

The broader view deals with (1) parallel ways in which all living systems process information to reduce uncertainty; (2) higher education and its institutions as huge, dynamic information systems in and of themselves; and (3) organizational information systems for operations and management purposes.

In a rather remarkable book, James Grier Miller, a pioneer of systems science, describes the concept of generalized living systems in which (a) nineteen critical subsystems of complex structures which carry out living processes necessary for sustaining and evolving life and (b) these subsystems exist in and apply to seven hierarchical levels from cell to organ, organism, group, organization, society, and supranational system. It seems significant that the function of nine of the nineteen critical hierarchical subsystems is to process information. The nine information-processing subsystems are called: input transducer; internal transducer; channel and net; decoder; associator; memory; decider; encoder; and output transducer. (The other subsystems process matter-energy.) Miller notes that his work on organizational levels has applications in facilitating operations research, improving administration, and developing management information systems.

Processing information and carrying out learning appear innate to evolution and to the forces antecedent to the powers of perception. According to Miller, this applies to individuals, organizations, and societies alike.

Higher education, including each of its institutions, is itself fundamentally a huge, dynamic, information system. Institutions of higher education are commonly described as organizations whose purpose is to produce and transmit knowledge to diverse constituents through processes of instruction, research, and public service. Closing the gap between the unknown to the known is the basis for the information and learning activities in higher education as in other living systems.

We may tend to think of our institution not as a big information system but as an intellectual, social, and economic process. This process of higher education, sometimes referred to as a major part of the knowledge industry, is obviously information-driven and has information systems, like managerial systems, which are comprised of letters, books, microfiche, worksheets, films, and such other artifacts as computer cards and tapes, not to mention the human mind.

Organizational information systems specifically developed for operations and management purposes are, of course, one of these many pieces of the total higher education information system. On purely judgmental grounds, let us imagine that these operating and management information systems represent roughly one percent of the total institutional information system. These administrative information components may be characterized as having the same nine critical subsystems for processing information as all other living systems, and as useful in closing the gap between specific knowns and uncertainty.

Turning to the second view, more related to vertical information systems and task uncertainty, it is appropriate to highlight the nature of higher education with such dimensions as openness of the system, complexity of environments, multiplicity of role and goal demands, kinds of governance, and kinds of tasks. Each of these facets has internal and external elements. In addition, a most significant dimension is the high degree of diversity among institutions in this and other matters.

This second view may offer nothing new to those familiar with higher education, but it is a necessary part of the total picture to be portrayed here.

Institutions of higher education, especially in the public sector, are very open systems with many constituencies ("resource inputs"), broad functions and resource categories ("processes"), and general expectations ("outputs"). The openness of the system increases the range and volume of demands and expectations placed upon an institution, many of which translate into performed tasks.

Complex environments affecting an institution of higher education may be described using Richard Hall's seven "environmental conditions" consisting of the technological, legal, political, economic, demographic, ecological (relationships with other organizations), and cultural conditions. Given that higher education (a) deals with instruction and research in these areas and others, as well as (b) experiences the effects of these conditions, the internal-external complexity of tasks performed by an institution may be appreciated.

Another important dimension is the effect of rapid change upon performance of institutional tasks and on institutional information requirements. James D. Thompson stated that the locus of organizational uncertainty (of tasks) lies in interdependence with other organizations in the environment and that whether conditions are stable or shifting will determine whether greater certainty of tasks or uncertainty, respectively, will exist. Shifting environmental conditions and institutional interdependence with the environment are reflected in role and goal demands made of institutions of higher education.

Seven basic categories of institutional goals capture those typically described in a wide range of literature: (1) resource and goal governance/management; (2) political process; (3) social, welfare, opportunity; (4) humanistic, individual; (5) knowledge, learning, ideas; (6) diversity, equality, spirit; and (7) economic, manpower, resources. All of these may be seen as interlinked with each other. In short, these represent an enormous range of possible expectations from the higher education sector, not to mention a single institution.

Levels at which institutional goals may originate or be achieved add all of the complexity of hierarchical subsystems. The levels range from course activities, projects, and programs up through organizational units to state, national, and international levels. Both upward and downward influences occur.

Target groups of individuals whom the achievement of institutional goals will benefit are another dimension. Categories include students, faculty, staff, community, state, region, nation, and world.

By combining the latter three dimensions--goal categories, goal levels, and intended target groups--in a three-dimensional matrix, a rough schematic is produced of the nature of what is happening in higher education institutions.

Institutional management in higher education is further complicated by the "shared" governance principle in which authority for the management of a university is often fragmented because of diffused missions within diverse divisions of the institution (Besse). Students, faculty, adminstrators, and external agents play a part in the sharing of institutional governance.

> (The university's) missions is often blurred and, even where clearly stated, it varies for different people. Students themselves come to college for purposes that vary not only among students but among generations of students. Society at large cannot state specifically what it wants universities to do.

As suggested in the Carnegie report on the Governance of Higher Education, there tend to be no "overall" patterns of governance and organization in an institution. Instead, some parts of a campus may be operated as a democracy (such as student government), some as a corporation (such as the business affairs), some as a partial market (such as the course offerings), and some as a guild (such as the faculty authority over curriculum, grading, and research).

The kinds of tasks performed by institutions of higher education in order to fulfill the various missions are described generally within the broad categories of primary functions (instruction, research, and public service) and support functions (management, academic support such as library and computer facilities, physical plant, and auxiliary services). Specific tasks and subtasks, however, recognizing the diversity of goals, disciplines, missions, and functions within an institution, are almost too numerous for description. Some hint of the many tasks is given in the "program measures" documentation of the National Center for Higher Education Management Systems. As the kinds of student development (intellectual, skills, social, personal, career), kinds of research, and community service are described in more detail, the multiplicity of tasks (actual and potential) becomes evident. Another sense of the diverse tasks may be found in examination of organizational operations and interrelationships (recruiting, purchasing, forecasting, resource allocation, support services, evaluation, operations research, and so on--and their interaction with instruction, research, and public service.)

This synopsis of the nature of higher education in terms of environmental influence, role and goal demands, governance, and tasks, points to the various reasons for task uncertainty in higher education.

REASONS FOR TASK UNCERTAINTY IN HIGHER EDUCATION AND POTENTIAL DISTANCE BETWEEN PERCEIVED VERSUS ACTUAL ORGANIZATIONAL TASKS

Reasons for task uncertainty in higher education include the great volume and diversity of tasks; multiple-goal interaction of some tasks, as in the case of "joint product" between instruction and research; various degrees of task integration; differences and changes in environmental dependency of tasks; mixture of formal and informal organizational structure; mixtures of fragmented versus centralized authority; organizational level and function from which tasks are perceived; and on going lack of the necessary information (input-output-goal).

Organized and detailed information on whose goals are or should be enacted in higher education at a given time typically do not exist. Even if one could determine what immediate data best reflect goals and their task accomplishment, qualitative and longitudinal evaluation information would also be needed. And even if all of this information could be assembled, the cost would be a prohibiting non-production drain on scarce resources.

In cases where task-related information might exist, insufficient variation is allowed for different types of units and disciplines. Studies show, for example, that the more difficult and variable the task, the lower the information available and the lower the uniformity of information (Poole). Regarding the interface between varying technologies of disciplines, which vary widely within an institution, and their respective information systems, there are four patterns of information systems (concise, elaborate, cursory, and diffuse) associated with four kinds of technology (programmable, technical-professional, craft, and research). The extent of task knowledge understood and degree of task variety are related to information use, amount, and ambiguity (Daft and MacIntosh). Another study revealed that the degree of task uncertainty varies among organizational sub-units; that three sources of task uncertainty are sub-unit task characteristics, environment, and inter-unit interdependence (Tushman and Nadler). Organismic rather than mechanistic sub-unit structures, i.e., those with highly connected communication networks, have greater ability to deal with work related uncertainty.

Turning to the matter of potential distance between perceived and actual task performance, this appears to result from both the lack of information and the level, position, and knowledge of the viewer. The farther the distance between the viewer and the task, the greater the uncertainty. This distance, or gap, can occur in organizational level; location external rather than internal; prior experience with the given kind of task; and, of course, adequacy of descriptive and interpretive information.

EXTERNAL REQUESTS FOR INSTITUTIONAL INFORMATION

The volume and increase in external requests for information from state (and federal) agencies are widely recognized. These requests have been described in terms ranging from the appetite of state budgeting agencies and coordinating bodies for information (Balderston), to the confusion and inconsistency over what is reported, to whom, and with what assumptions in mind (Glenny). Pressures for cost reduction lead to attempts on the part of external funding agencies to examine institutional activities and practices in more detail for purposes of accountability, cost (revenue) cutting, and expenditure control. Dollars are related to broad categories of institutional tasks (i.e., instruction, research, public service, institutional support, and so on). Requests are also made at more detailed levels of activity, such as by school or department. Many of these requests, at both broad and specific levels, appear aimed at resolving externally perceived uncertainties about various tasks being performed. For instance, does instruction at institution W cost too much? If so, why? Is program A too similar to program B? And so on. Information is reported as part of budget request documentation, in separate recurring reports, and through special studies.

Along with the problems of financial constraint and increase in external demands for information, there also tends to be increased internal administrative demand for information to get a better understanding of institutional trends and conditions, and to help discover new ways to deal with issues.

Much of the information deals with quantitative counts of students, faculty, staff, credit hours, dollars for supplies, physical plant, and so on. But many of the questions and requests focus on task uncertainty. For example, can program Z be eliminated? Can the overall faculty teach more? Do all students have equal access? And so on.

ORGANIZATIONAL STRATEGIES FOR DEALING WITH TASK UNCERTAINTY

Regarding task uncertainty in organizations, what are some alternative ways for dealing with this problem?

Jay Galbraith offers the proposition that the amount of information needed to perform a task is a function of the diversity of outputs, of the different input resources utilized, and of the level of goal difficulty. Galbraith further posits that the greater the uncertainty of the task, the greater the amount of information that has to be processed (during task execution) between decision makers. He states that the amount of information required to perform a task minus the amount of information already possessed is equal to the uncertainty. Finally, Galbraith suggests that in responding to uncertainty, an organization's volume of information becomes substantial, and the organization either finds ways to process the information or discovers ways to avoid having to do so.

Galbraith identifies four strategies available to organizations when faced with uncertainty: (1) creation of slack resources, (2) creation of self-contained tasks, (3) creation of lateral relations, and (4) investment in vertical information systems.

Creation of slack resources is a matter of increasing available resources and reducing the required performance level in order to permit an achievable amount of information processing. Creation of self-contained tasks involves functional task design in which each group or unit has all the resources it needs to perform its tasks. A corresponding shift occurs in authority structure. This strategy allows improved capability to create all or more of the information required to reduce uncertainty. Creation of lateral relations shifts decision making down to the task level, cutting across lines of authority, focusing on the level where the most information exists. Investment in vertical information systems involves the collection of information at the points of origin and directing it to appropriate places in the decision hierarchy without overloading communication channels.

At least three of the four alternatives have been used in higher education. It may be argued that in the past, say twenty years ago and prior, institutions used the self-contained units and tasks strategy, followed by the creation of lateral relations, especially in the larger institutions. Given the funding basis and non-profit nature of higher education, creation of slack resources tends to be precluded as an alternative.

SELECTION OF THE VERTICAL INFORMATION SYSTEMS STRATEGY

The current strategy for dealing with task uncertainty in higher education leans toward investment in vertical information systems. The vertical information systems strategy is defined as the use of new information technology to create improved or new channels of communication which introduce improved or new decision mechanisms more directly (vertically) into higher levels of management (Galbraith). This strategy is gained by means of substantial investment in computer hardware, programming effort, and computer time to collect information at the points of origin and direct it at appropriate times to appropriate places in the hierarchy. In higher education, these systems are often capable of extending beyond top administrative levels and on to external agents.

This current strategy seems to be the practical alternative for higher education in response to pressures for more complete analytical data to demonstrate performance and justify ongoing appropriations. Evidence of the utilization of this vertical information systems alternative has been widespread in terms of the design, testing, and implementation of hardware, software, and associated management systems. Institutional administrators, faculty committees, state agencies, and national task forces have been involved in efforts to create data bases and analytical methods aimed at providing measures of performance, the quantification of goals and objectives, indicators of efficiency and effectiveness, and other descriptive or analytical information designed to extend from the operational level through middle management to the top administrative levels and then to state and federal levels.

The important questions are: How successful have these systems been? How far have they been developed? What can be done to improve them?

APPARENT SUCCESS TO DATE WITH VERTICAL INFORMATION SYSTEMS

While there has been substantial effort to date in attempts to develop vertical information systems, the state-of-the-art is not too advanced because of a variety of limitations and problems having to do with faulty conceptual assumptions; insufficient resources; insufficient kinds of data; the abstraction of data; difficulty in generating goal-related data; insufficient attention to environment; lack of integration of data; insufficient awareness of systems behavior; and misuse of information.

Faulty concepts and underlying assumptions include such things as expecting a single set of data elements and processes to adequately describe higher education (Wyatt and Zeckhauser); assuming that a comprehensive decision-information system can be built, that systems analysts know what information is needed, and that state and institutional information needs are compatible (Schroeder); and that operating data systems will adequately provide a means of vertical information reporting (Balderston).

Sufficient kinds of data have not been incorporated which are necessary to properly understand and interpret information for rational decision purposes. Irrespective of qualitative measures, many relevant quantitative measures are not captured, largely because of resource constraints and also because of lack of understanding the significant factors.

Abstraction and reduction of data also produces problems of understanding and interpreting, which compound rather than help resolve uncertainty. Institutional systems dealing with behavioral processes typically can handle only a small number of relatively superficial (i.e., abstracted) facets to start with. In the aggregation or reduction of reports and interpreted information a phenomenon called "uncertainty absorption" (or information absorption) often occurs in which meaning is transformed into perceptions of the meaning and communicated upward (Radford). Information absorbed close to the source is abstracted when summarized such that it may not be understood (Miller). When information (such as on costing) is aggregated, it begins to lose programmatic and decision relevance (Carruthers and Orwig). Much information falls out of context because of its level of aggregation. The other kinds of limitations have been described by a number of higher education practitioners and observers (including Lawrence, Topping, Casey and Harris, Saunders, and others) are not discussed here.

The main point is that a large number of limitations have kept vertical information systems from achieving anticipated results and benefits. Better results seem to have been attained at the insititutional level that at the external level. But the problems to be resolved appear far more formidable than the results achieved.

THE PRESENT DILEMMA OF VERTICAL INFORMATION SYSTEMS IN HIGHER EDUCATION

The meager state of available information systems does little to abate the external demands for performance and accountability data. Institutions are pushed into generating inadequate kinds of information by the threat that if they do not provide the data someone else will provide it on their behalf or that, lacking any data, "snap decisions or power decisions" will be made (Balderston).

The substantial cost to develop information systems, a tendency for vendors and/or state agency or institutional "developers" to overstate the capability and to oversell information systems that may still be experimental, and external pressure to produce more information all foster expectations of information systems delivery capabilities that cannot be met.

Institutions stand to lose out by continuing to provide information that inadequately and improperly portrays performance, productivity, and mission. They also stand to lose if they do not provide this inadequate information because of the threat that in its absence externally created or politically-based judgments will be made affecting the funding of all or selected programs and functions.

RECOMMENDATIONS FOR COPING WITH THE STATE-OF-THE-ART OF VERTICAL INFORMATION SYSTEMS AND TASK UNCERTAINTY

The challenge appears to be to greatly improve vertical information systems and, in all likelihood, to do so with existing or planned resources. As institutions undertake new design or improvement of systems, those resources should be used in part with an attempt to incorporate the following recommendations:

- develop integrated and relational data bases that contain common elements for all disciplines and units and also supplemental elements which describe the unique attributes of each;
- in developing systems, give greater attention to the purposes for and environment in which the data are used and to managerial and analytical requirements;
- try to keep technical systems goals of the information system from usurping priority over the main objectives of the information;
- encourage dialog between systems developers and data users at all levels aimed at clarifying underlying assumptions and overcoming information absorption;
- try to promote the idea of incrementally building goal linkages and outcome measures into the information system;
- identify needed information that will be created in the operating systems and that which must be created in non-operating systems; and assist in designing these non-operating information systems.

BIBLIOGRAPHY

Balderston, Frederick E., *Managing Today's University*. San Francisco: Jossey-Bass, 1974

Besse, Ralph M., "A Comparison of the University with a Corporation" in *The University as an Organization*, Edited by James A. Perkins, New York: McGraw-Hill, 1973, pp. 107-120.

Cameron, Kim, "Measuring Organizational Effectiveness in Institutions of Higher Education", in Administrative Science Quarterly, December, 1978, Vol. 23 (pp. 604--34).

Carruthers, J. Kent and Melvin Orwig, *Budgeting in Higher Education*. Washington, D.C.: ERIC Clearinghouse for Higher Education and American Association for Higher Education, 1979.

Casey, Robert J. and John W. Harris. *Accountability in Higher Education: Forces, Counterforces, and the Role of Institutional Accreditation*. Washington, D.C.: The Council on Postsecondary Accreditation, 1979.

Daft, Richard L. and Norman B. MacIntosh. "A New Approach to Design and Use of Management Information." in *California Management Review*, Fall, 1978, Vol. 21, No. 1. (pp. 82-92).

Donald, A.G. *Management, Information, and Systems*. Oxford: Pergamon Press. 1967.

Galbraith, Jay. *Designing Complex Organizations*. Reading, Mass: Addison-Wesley. 1973.

Gall, John. *Systemantics: How Systems Work and Especially How They Fail*. New York: Quadrangle/The New York Times Book Co., 1975.

Gifford, William E., H. Randolph Bobbitt, and John W. Slocum, Jr., "Message Characteristics and Perceptions of Uncertainty by Organizational Decision Makers." in *Academy of Management Journal*, 1979, Vol. 22, No. 3 (pp. 458-481).

Glenny, Lyman A. *State Budgeting in Higher Education: Interagency Conflict and Concensus*. Berkeley: University of California Center for Research and Development in Higher Education, 1976.

Hussain, Khateeb M. *Development of Information Systems for Education*. Englewood Cliffs: Prentice-Hall. 1973.

Lawrence, Ben. "Accountability Information: Progress, Pitfalls, and Potential." in *Preparing for the New Decade*. New Directions for Higher Education. San Francisco: Jossey-Bass Publishers, No. 28, 1979.

Mack, Ruth P. *Planning on Uncertainty: Decision Making in Business and Government Administration*. New York: Wiley Interscience, 1971.

Meredith, Mark. "Information Needs, Limitations, and Applications in Understanding Interinstitutional Instructional Cost Differences." Paper presented at Association for Institutional Research Forum, May, 1979.

Miller, James Grier. *Living Systems*. New York: McGraw-Hill, Inc., 1978.

National Association of College and University Business Officers, and the National Center for Higher Education Management Systems. *Costing for Policy Analysis*. NACUBO, 1980.

Poole, Marshall Scott. "An Information-Task Approach to Organizational Communication." in Academy of Management Review, July, 1978. (pp 493-504).

Radford, K.J. *Information Systems for Strategic Decisions*. Reston, Virginia: Reston Publishing Company, Inc., 1978.

Saunders, Laura E. "Dealing with Information Systems: The Institutional Researcher's Problems and Prospects." in *The AIR Professional File*, the Association for Institutional Research, Summer, 1979, No. 2.

Schroeder, Roger G. "Management Systems Design: A Critical Appraisal." Paper presented at the Association for Institutional Research 16th Annual Forum. May, 1976. 13 pages.

Thompson, James D. *Organizations in Action*. New York: McGraw-Hill. 1967.

Topping, James R. and Glenn K. Miyataki. *Program Measures*. Technical Report No. 35. National Center for Higher Education Management Systems. Boulder, Colorado. February, 1973.

Topping, Jim and Ed Myers. *Information Exchange Procedures for Major Research Universities: Alternative Conceptual Approaches*. Boulder, Colorado: National Center for Higher Education Management Systems, March, 1979.

Tushman, Michael L. and David A. Nadler. "Information Processing as an Integrating Concept in Organization Design." in *Academy of Management Review*, July, 1978. (pp. 613-624).

Wyatt, Joe B. and Sally Zeckhauser. "University Executives and Management Information." in *Educational Record*. Vol. 56. No. 3. Summer, 1975. (pp. 175-189).

ENVIRONMENTAL MANAGEMENT AND RETENTION: A SYSTEMS APPROACH

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This paper outlines a comprehensive approach to the enhancement of retention activities. It describes a model known as METER (Management Efforts To Enhance Retention) that is based upon the systems approach to problem solving. METER has four components, two of which systems practitioners are the primary persons to facilitate, the Data-Base Foundation component, and the Retention Planning Focus component. The model operates from a formulation built upon human develoment and educational theory. It facilitates the actualization of the college environment (stimuli) and centers upon student and faculty satisfiers and dis-satisfiers. This foundation and its functions are outlined in the Retention Philosophical Framework component and the Developmentally-Based Activities component. The system can function in either a manual or computer mode. The paper provides an overview of the model and is primarily designed to facilitate further discussion.

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Environmental Management and Retention: A Systems Approach

Until recently, most studies of the "attrition" problem have concluded that the main reasons for attrition was the lack of adequate financial aid and the appropriate academic programs. However, this appears to be changing.

The most recent work of Beal and Noel (What Works in Student Retention) highlights many retention activities that are centered upon the affective domain as well as improved academic advising. It is interesting to note that the programs that these practitioneers have featured do not include a program featuring the allocation of financial aid. Having been involved with several of the colleges included in this project and having consulted at some 20 others on all aspects of retention has led me to believe that possibly our historical data base pertaining to attrition causes needs to be updated. This experience has also made me aware of the depth and width of the attrition issue and that perhaps our programmatic responses are not yielding the best results for the investment.

In this paper I am presenting, in summative form, the model that I have been designing, developing, and testing for the past seven years. The model is not complete nor does it have all the answers. Having had a significant role in the design and development of one of the models featured in the Future of Student Affairs (Miller and Prince, 1977), I am aware of the responsibility that is/will be inherent with this paper. Having implemented the Resource Requirements Prediction Model (see New Directions Series, College of St. Benedict), I am also aware of the documentation support necessary to transfer this model from this paper to implementation on your campus.

I have chosen the CAUSE National Meeting as one of the first professional meetings where I will publicly make this presentation for I believe that there are many data management people, institutional research people, and systems folks that are key to their institutions' retention and research efforts. I further believe that it is the "systems" person that has the problem solving skills, data management ability, and the understanding of the "game" of college that is necessary to apply systematic approaches to retention issues.

The METER (Management Efforts To Enhance Retention) Model is a comprehensive, systems based, campus-wide, "soft" model that provides a foundation, framework, and focus to integrate the resources of the campus to enhance retention. It is "soft" because it can accept institutionally-based theories, practices, and activities into its various components and modules. The model can operate in a manual mode as well as a computer-based mode. It is electic in a sense because its operational foundation is based upon the works of Astin, Pace, Noel, Chickering, Perry, Bowen, Bloom, Mayhew, and others. Inherent to its operation is a management information system, the integration of developmentally-based activities and it interfaces with institutional planning (and has its own retention planning focus). It is designed upon basic systems concepts and is result oriented. A historical perspective is available (under separate cover) that describes the creation of the various modules and components. This document outlines three years of institutionally specific activities as well as components created at other locations. It is suggested that an implementation team be familiar with the works of Astin, Pace, and Cope prior to initiating the implementation of METER.

1. **CONTEXTUAL FRAMEWORK:**

Before one starts to consider METER, some contextual framework is appropriate.

a. Definitions:

Environment: Astin (1972) and Baird (1980) utilize a definition of the college environment centering on the word "stimulus" with the idea being "that the actual behaviors of students and faculty and specific features of the college represent stimuli that affect each student's perceptions of the college as well as each student's own behavior. Astin expressed this idea as follows:

> The college environment was considered to include anything about the institution that could be regarded as a potential "stimulus" for the student. A "stimulus" was defined as any behavior, event, or other observable characteristic of the institution capable of changing the student's sensory input, the existence or occurance of which can be confirmed by independent observation.

In METER, the acceptance of this definition is important and the further classification of "observable characteristics" is an important task.

Retention: Is not the retaining of all students nor students that are "mis-matched" to the college (mis-matched by institutional definition), but rather the deliberate activities undertaken (based upon the mission and objectives of the college) to provide an overall environment that is conducive to retaining students that will receive "mutually determined benefits." Mutually determined benefits are formulated by the student and the institution through the various processes of relationships.

Systems Approach: There are many variations of the systems approach. The work of Kaufman (1976) is being utilized for METER. The approach has six steps:

a. Identify problem based on needs
b. Determine solution requirements and identify solution alternatives
c. Select solution strategies
d. Implement
e. Determine outcome effectiveness
f. Revise as required

The systems approach is utilized in the model as the processing framework to actualize the model.

b. Hypothesis: METER resonates from five major hypothesis which are:

1) One of the most important members of any set of people engaged in retention/attrition activities is a person that not only has data skills, but fully understands and applies a systems approach to the problem.
2) Most historical efforts in data collection and retention activities, even though helpful, are merely "icebergs" to the problem. However, the recent works of Astin, Pace, Noel, Cope, and others (see the bibliography) when viewed from a holistic human development model can be the foundation of a successful retention model.
3) That faculty are one of the most vital resources to retention for they are the true activitists (catalysts) to the stimuli that impacts the environment.

4) That retention programming (and especially the METER model) has to be accepted by chief administrators (and critical masses) and be integrated with the on-ging operation of the college.
5) That management (to include faculty and students) can efficiently, effectively, and humanly be successful in planning and doing retention.

2. COMPONENT DESCRIPTIONS:

METER has four major interactive components that operate within this contextual framework. The four components have been affectionately labeled R2D2.

a. Retention Philosophical Framework: This component is the expression of the institutions' mission and objectives in defineable terms (which often become measureable). It has three modules that can accommodate the theories, practices, and activities of the institution. The modules are:
   1) Academic Achievement: This module contains those general academic goals that most institutions are facilitating. These could be verbal, writing, reading, etc. They could also be of the type that Alverno College has. They could also be the general education curriculum. They are representative of what the institution is about academically. From a retention/attrition viewpoint, we are interested in knowing about students that are not achieving them and rewarding those that are.
   2) Human Development Module: This is a very important module. This is where the instituton would plug in its own student services (development) goals. In many cases, the human development theorists (i.e., Chickering, Perry, Heath, etc.) would have their models/ vectors described here. In those institutions that are engaged in valuing, the valuing framework would also be included. Any other affective goals would be included here as well as three educational by-products: self discovery, satisfaction, and career exploration. From a retention/attrition viewpoint, we are interested in knowing the students' progression in this area of development.
   3) Environmental Milieu: This module deals with the who and what the institution is. It includes information on history, key events, faculty, spirit of place, stimuli, observable characteristics, etc. Utilizing Astin (1968) and Baird (1980), the environment can be classified into: a. peer environment, b. classroom environment, and c. the administrative environment, plus two other elements, the physical environment and the college image. C. Robert Pace's work (1976 and 1980) adds additional dimensions to these classifications, namely, personal development and environment, relationships to the environment, and overall features/impressions and most recently quality of time and effort. From a retention/attrition viewpoint, we are interested in knowing what the college environment is like from many facets and the experiences of the student in the environment. This module is key to the model.

b. Data Base Foundation: This component is one of the major driving forces of the model. It provides information to the Needs Analysis and Outcome Effectiveness steps of the systems approach. This component has three modules:
   1) Assessment: This module contains all types of surveys and instrumentation to assess the need for and delivery of services throughout the entire institution. It has instruments dealing with academic achievement, human development, environment, allocation resource

management, and other cost-related areas. It utilizes Baird (1980), Pace (1980), and Astin (1980) as its reference point.

2) Individual: This module contains data that represents people--students, faculty, administration, staff, and others. On students, it has the data collected during admissions, data collected during the experience of the environment, and data pertaining to outcomes. The works of Astin (1976) and Markovich (1974) are utilized as the reference points.
3) Management: This module contains the data that developmentally-based activities are built from--data the Retention Planning Focus utilizes for planning. It has the capability to generate retention statistics by major, advisor, dorm, student type, activity analysis, etc.

c. Developmentally-based Activities: This component is the structure that is responsible for research, development, and implementation of activities (and stimuli) to enhance retention. Some of the historical student programming (activities) could be included in this component. It utilizes the Retention Philosophical Framework as one of its yardsticks to ascertain whether an activity has merit and what resources should be allocated. It utilizes data from the Data Base Foundation to determine what activities are needed and what resources are available. It acts as a broker-agent for the college. It is not only concerned about historical student (after five o'clock) activities, but is also concerned about curriculum and the articulation of the institution's mission and objectives. It has considerable guidance and advisement from the faculty and other key individuals.

d. Retention Planning Focus: This component is designed to provide an on-going planning capability to actualize the model. It is linked to the overall institutional planning model and can interface with "unit plans" and curriculum planning. It is a ten step approach to planning which incorporates Kaufman's systems approach. These steps are:

1) Review of the retention "State of the Union" including:
    a) Institutional mission and objectives
    b) Retention Philosophical Framework
    c) Input from the Data Base Foundation component
    d) Other institutional planning data
2) Development objectives (problems) to be solved/accomplished. This could be considered a Needs Assessment. The Assessment Module of the Data Base Foundation component would provide primary input.
3) Review developmentally-based activities.
4) Based upon Needs Assessment and problem/objectives statement, determine solution requirements and identify solution alternatives.
5) Select solution strategies.
6) Develop the PAR (Plan for Action in Retention) which includes key dates, events, people, and resource allocation.
7) Develop the MAP (Management Action Plan) which is planned on how the PAR will be implemented. What actions will management take and what messages need to be delivered. What major institutional roadblocks need to be addressed?
8) Implement the PAR utilizing the MAP.
9) Determine outcome effectiveness. This interfaces with the Assessment Module of the Data Base Foundation component.
10) Revise as required. This can be and should be an on-going process.

This planning process is designed to be utilized both for long-range planning as well as short-range and strategic planning. It could be a sub-unit of the college's long-range planning model. In its ideal state, the Retention Planning Focus could be identified within each element of the college. The rationale for PAR and MAP is simply that the group formulating the PAR may not have the cross-institutional authority to impact other areas than their own and the fact that chief administrators need to know what is going on.

In summary, these four components provide the foundation, framework, functions, and feedback mechanisms for the METER Model. They are designed to accept and utilize current institutional activities and provide linkages to the on-going operations of the college.

3. METER IN ACTION:

The success of METER is based upon the interaction of the components, the integration of the model with the institution, and the continual utilization of the systems approach during its life cycle. Needless to say, any model has to be adjusted to the site and the conditions that exist. METER is designed to include large numbers of campus personnel in its operational framework and to facilitate a campus-wide orientation on the retention issue.

The previous two sections of this paper outlined in general form the technical basis of METER and its structural framework. Installation of the METER model based upon this information will yield some results, but the real success of METER comes from the implementation of a holistic, integrated, and on-going approach to retention. The real question of how does METER or any retention program improve retention is the issue. The rationale for METER is quite complex, its major thrusts are outlined below:

a. Retention happens because the numbers of "satisfiers and dis-satisfiers" on campus in all populations (students, faculty, administration, and staff) are in balance by individual community members. This translates to the stimuli of attrition and retention, thusly, the college environment under some form of management. As in any organization, people leave because the satisfiers are not adequate. The same with students. The old horse of financial aid is one satisfier that is easy to identify, other satisfiers (and dissatisfiers) are not as easy to identify nor measure.

b. Faculty are the key to the college environment for they affect peer, classroom, and administrative environments. They should impact the physical environment and in many instances create the college image. They are and can be the major facilitators of the academic achievement, human development, and the educational by-product goals of self-discovery, satisfaction, and career exploration. When faculty are satisfied, students receive satisfaction also. Historical satisfiers for faculty may be passe and new satisfiers need to be encouraged.

c. METER is successful because it involves the entire environment and the entire environment impacts retention. It operates within the mission and objectives of the institution,has a data base to provide assessment, individual information, and management information. It has the capability to foster a plan of action that not only includes retention activities but also a Management Action Plan. It has an available inventory of developmentally-based activities that are delivered by the entire college community.

METER is intended to be implemented in two phases as outlined below:

PRE-PLANNING PHASE: In this phase, the Retention Philosophical Framework is developed, needs assessment is conducted, inventory of current developmentally-based activities are initiated, and the beginning data base is formulated. Steps one through four of the Retention Planning Focus are used as the guidelines for this phase.

CREATION/IMPLEMENTATION PHASE: This is the on-going phase that is designed to be recycled and revised on a yearly basis. Essentially, the following would occur:

a. Review of Assessment, Individual, and Management modules of the Data Base Foundation to assist in developing the retention "State of the Union."
b. Proceed to the Retention Planning Focus step two.
c. Compare this Needs Assessment to the one developed in the Preplanning Phase to see if they are similar. If they are, proceed with step three. If not, perhaps more attention needs to be spent on developing Retention Philosophy, Data Base Foundation, or other components of the model.

4. SUMMARY:

In this paper, I have presented the highlights of the METER model, more descriptive material is available from the author. Workshops are being planned to assist in the implementation of the model. Its framework provides a centered and direction for comprehensive retention philosophies and functions. Its planning focus integrates the model with the institution. It reinforces the role of the faculty and utilizes data for its guidance. Its philosophical framework is built upon the theories of human development and educational competence.

The model goes far beyond the delivery of quick fixes ar activities. It requires an institution to address retention from an institutional viewpoint and a human development concern.

The appendix outlines a very basic implementation strategy (guideline) for just one component. It is included so that people considering implementation can see the potential impact on campus and the commitment necessary for implemenation. It has been suggested that implementation be considered in phases. The author is undertaking activities to develop a phased approach to implementation and is seeking pilot colleges for this effort.

The bibliography outlines the foundation for the METER. The author believes that these theorists and practitioners have provided a significant foundation for this model. However, all of the work contained herein is solely the work of the author and to the best of his knowledge, no model of this type exists.

APPENDIX

IMPLEMENTATION GUIDELINES:

The success of METER is based upon the interaction of the components, the integration of the model with the institution, and the continual utilization of the systems approach. Needless to say, any model has to be adjusted to the site and conditions that exist. METER is designed to include large numbers of campus personnel and facilitate a process of inter- and intra-institutional activities. The following guidelines are suggested to assist in implementation:

a. Retention Philosophical Framework: This component can be developed with practically the entire college community participating. The process utilized to determine the ingredients for the various modules could consist of Delphi Technques, surveys, faculty committees, research papers, forums (Town Halls), and other processes that facilitate discussion. The ETS IGI could be utilized as a launching point. During the institution's long-range planning process during mission and objective review, this could be the by-product. In a subjective sense, opinions could be gathered on what "type" of students complete at your institution. What are their entering verbal, written, and reading skills. Where are they on any human development continuum, what is their values orientation. And most important, what is the environment? What do climate surveys reveal? What is the campus like when it rains? Is there enough privacy on campus for students? What is dorm experience? The results of this creation/implementation activity could possibly produce the following:

   1) Academic Achievement:

      a) A set of generalized academic goals with appropriate scaling to be utilized in informal assessment to ascertain whether a student is going to achieve the goal and complete the educational goal.

      b) A review of the reward system to ascertain that quality of effort and time are being rewarded. Also, that rewards are distributed in a timely manner to the performance.

      c) A set of early warning indicators on "Non-Academic Achievement" that could be utilized in early identification of attrition prone students.

      d) A set of guidelines to be utilized on entering students that do not possess the necessary educational background to be successful in order that more appropriate class scheduling can be developed. For example a student with low reading scores NOT being scheduled into 12 units of courses with significant (and technical) reading requirements. Of course, this activity is based upon institutional objectives.

   2) Human Development Module:

      a) Campus-wide articulation of what the Human Development Model is. The dimensions that it includes and observable characteristics of movement.

b) Development of an "extra" curricula (or second curriculum) that assists students in human development.

c) Campus-wide understanding of the nature of "values" and what they look like on your campus. Within the human development context what type of "value sets" appear to be prone for possible attrition.

d) A complete description of the institution's statement on self-discovery, satisfaction, and career exploration. Many students are coming to college with preformed statements that may be vastly different than the institution's, especially in the area of career exploration.

3) Environmental Milieu:

a) Definite descriptions of what the peer, classroom, and administrative environment are and if there are major problems. To wit apparent "they-us" feelings. Administrative services "out-of-balance," to wit some offices and people really friendly and others. . . .

b) In depth knowledge of the physical environment. This includes all facilities on campus and those within easy proximity. An approach to accomplish this task is teams of investigators that visit the various facilities and see it from a student's viewpoint.

c) An up-to-date study of the college image. What do you look like from the outside. What is literature portraying. What word sets are being utilized about your mission and objectives.

d) Information on how students relate to the environment. Does the environment force students to choose mates, always travel with the same people in the same rooms.

e) Utilizing Pace's (1980) work what is the relationship of your student to the environment based upon quality of effort and time. Are students able to engage faculty in heavy discussions. Utilize the research aspects of the library.

REFERENCES

Astin, A. W., The College Environment (Wash., DC, ACE, 1968)

Astin, A. W., Manual for the Inventory of College Activities (Minneapolis, Minn., National Computer Systems, 1972)

Astin, A. W., Preventing Students From Dropping Out, Jossey-Bass, Inc., Pub. 1975

Astin, A. W., Student Oriented Management Information Systems, Paper 1976 and Baird, Harnett and Associates, Understanding Student and Faculty Life, Jossey-Bass, Inc., Pub., 1980

Astin, A. W., Four Critical Years, Jossey-Bass, Pub., 1977

Astin, A. W., When Does A College Deserve to Be Called "High Quality," in Current Issues in Higher Education (Wash., DC, AAHE, 1980)

Baird, Harnett and Associates, Understanding Student and Faculty Life, Jossey-Bass, Inc., Pub., 1980

Beall and Noel, What Works In Student Retention, (Boulder, Colo., NCHEMS at WICHE, 1980)

Bloom, B. S., Hastings, J. T. and Madanes, G. F., Handbook on Formative and Summative Evaluation of Student Learning, McGraw-Hill, pub., 1971

Bowen, Howen R., Investment In Learning, Jossey-Bass, Inc., Pub., 1976 see also New Directions for Education and Work #2, (pp. 79-94), Jossey-Bass, Inc., Pub., 1969

Chickering, A. W., Education and Identity, Jossey-Bass, Inc., Pub., 1969

Cope and Hannah, Revolving College Doors, Wiley and Sons, Pub., 1975

Kaufman, Roger, Identifying and Solving Problems: A Systems Approach, University Associates, Pub., 1976

Markovich, Greg and Frame, S., Student Centered Management Information System, (Azusa, CA; Exxon Ramp Report, 1974)

Markovich, Greg, MIS Handbook for Small Colleges (Wash., DC, Small College Consortium, 1977)

Mayhew, Lewis B. and Ford, Patrick J., Changing the Curriculum, Jossey-Bass, Inc., Pub., 1973

Mayhew, Lewis B., Surviving the Eighties, Jossey-Bass, Inc., Pub., 1979

Miller and Prince, Future of Student Affairs, Jossey-Bass, Inc., Pub., 1977 see Azusa Pacific College and SCMIS

Pace, C. R., Education and Evangelism: A Profile of Protestant Colleges, McGraw-Hill, Pub., 1972

Pace, C. R., UCLA: Who Goes? What's It Like? (LA, CA, UCLA Lab for Research in Higher Education, 1976)

Pace, C. R., Measuring the Quality of Student Effort, in Current Issues in Higher Education (Wash., DC, AAHE, 1980)

Perry, W. G. Jr., Forms of Intellectual and Ethical Development in the College Years, Holt, Rinehart and Winston, Pub., 1970

St. Benedict, College of, New Directions for Institutional Dev. #15, Jossey-Bass, Inc., Pub., 1976

A LONG RANGE DATA PROCESSING PLAN ENHANCES PRODUCTIVITY

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A LONG RANGE DATA PROCESSING PLAN ENHANCES PRCDUCTIVITY

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INTRODUCTION

The phrase, "We never have time to do it right, but we always have time to do it over," is often heard in data processing organizations. One reason our most precious resources (personnel) are not efficiently used is because of the constant system changes eminating from the numerous organizational elements we serve at various organizational levels. Without a clear definition of long range management information requirements, the data processing organization may have to analyze the same system three or four times annually as changes come from different organizational levels or elements. The missing link is a Long Range Data Processing Plan which consolidates the management information requirements to be satisfied using data processing resources. The purpose of this paper is to define a systematic approach to long range planning.

A long range data processing plan provides a road map for the data processing organization to take it from where it is today to where it should be going over a long period of time, approximately five (5) years. For several years now, numerous noted speakers have been emphasizing the importance of long range planning within the data processing environment. At the National Computer Conference in Dallas, Texas in 1977, a one day seminar was presented by Benjamin Knowles of Brandon Systems Institute, Inc., Bethesda, Maryland, on the subject, "How to develop a long range data processing plan."

At the Ninth Annual Seminar for Academic Computing Services at Snowmass, Colorado in August of 1978, Richard A. Pereless from the National Telecommunications and Information Administration, Department of Commerce, Washington, D.C., (formerly called Telecommunications for the White House), gave a presentation to the nationwide Academic Computing Services Representatives on Telecommunications. The main point of his presentation on the subject, "Telecommunications make the good old days slightly obsolete," was that yesterday, today, and tomorrow are completely different. The environment and technology are changing rapidly. Therefore, his closing words to the Data Processing Managers had to do with planning. Mr. Pereless stated, "The key to your success will be proper planning. Long range planning that will take two to five years and will commit your University to long term programs." While he spoke about the relationship between the data communications and the data processing environment, the same can be said of a long range data processing plan.

In his article, "New Templates for Today's Organization," Peter F. Drucker, writing for Harvard Business Review in January of 1974 stated that each organization has three major tasks: "1) the operating task which is responsible for producing the results of today's business, 2) the innovative task which creates the company of tomorrow and 3) the top management task which directs, gives vision, and sets the course for business of both today and tomorrow." The long range data processing plan provide the "vision" or direction as to where we are, where we want to go, what resources we need to get there, and what objectives we are trying to accomplish. It should become the top management tool that holds the various organizational levels together; thus, all are working as a team to accomplish the same major objectives.

COMMUNICATION

A weakness in most organizations is that of communication, both vertically and horizontally. How does one communicate objectives from the top level management at the top organization involved down to the programmers/analysts who must perform at a technical level in order to accomplish the objective of the organization?

Communication is one of the most important factors because it is essential in the process of developing a long range data processing plan. The modern progression of the data processing industry over the past twenty-five years brings to mind a Bible story from the Book of Genesis. In the story, the people were building the tower of Babel and, at that time, they all spoke one language; however, the Lord said, . . . "let us go down, and there confound their language, that they may not understand one another's speech."

Several years ago, a list of deadly sins pertaining to data processing managers was published in the Harvard Business Review. One of those deadly sins involved the poor communication between data processing managers and users or functional managers. Data processing acronyms such as MVS, COBOL, ALGOL, PASCAL, TSO, JES3, ADABAS, DBMS, DMS, etc. have very little meaning to an accountant or to a Director of Personnel who communicates from a completely different set of words or meanings. One of the surest ways to turn off functional users is to try to confuse them with technical knowledge. Data processing managers have tried for years to impress the top level managers with their technical expertise. Using this approach is, in the long run, nonproductive.

In order to have open, clear and concise communication, the following are essential: Sender ⟷ Media ⟷ Receiver.
The sender and receiver must be able to communicate effectively using their knowledge, background, experience and skills to accomplish the purpose of communication so that the message from sender to receiver via media (i.e., verbal, electronic, or written communication) is completely understood. These principles apply regardless of the form of communication. Furthermore, the sender and receiver must be on the same frequency if they are to understand one another. Therefore, in order to develop a clear channel of communication for this paper, the terms that are used throughout the paper will be defined to insure a clear understanding of their meanings. The definitions of these terms have been paraphrased from different dictionaries.

DEFINITIONS

Authority - power to make decisions based upon assigned responsibilities.

Automated Data System - a collection of procedures, personnel, data processing equipment and communications organized to accomplish a specific activity or function by the different organizational levels involved. For example: A Payroll System, Personnel System, Admissions, etc. may be designed to meet management information requirements at three or more organizational levels.

Capable - ability to support a data processing configuration, software, programming language, etc., i.e., capable of supporting COBOL on-line with five terminal devices vs. capacity to support COBOL with ten terminals.

Capacity - of a computer includes the amount of work or processing and the number of programs or jobs that can be executed during a specific period of time. The maximum capacity must have parameters that identify the period of time, response time, or other unit of measure required for a computer to meet the total workload. The capacity is a means of measuring a total processing workload that can be performed within a specific designated time period, such as an hour, day, week, month, etc. Capacity is different from capability in that a computer may be capable of processing a job but multiple jobs needed at the same time could exceed the capacity.

Compatibility - as used in the data processing environment indicates that the computer hardware, software and communications can function together to perform a specific function. For example: a programming language such as COBOL developed for the Hewlett-Packard computer may not be compatible with the IBM or DEC computers (or vice versa) without some modifications.

Concept - an idea that is conceived by an individual as a way to do or perform a certain function.

Constraints - the limitations or limiting factors such as the lack of the capability or capacity of a computer, or the lack of resources (personnel, funds, etc.) which may prohibit the accomplishment of an objective.

Data - elements of information used or produced by computer. Data may be referred to as the smallest unit of information processed by the computer, with the possible exception of bits or bytes.

Decision-Making - a process used to collect facts, weigh alternatives, and arrive at a logical, sound decision. The decision-making process may involve different organizations and different organizational elements, when dealing with data processing and establishing priorities for work to be performed.

Functional Managers - are the personnel responsible for performing certain functions which are some of the business applications supported by data processing, such as payroll, accounting, personnel, etc. In addition, there are other functional managers such as those in Research and Development in the scientific environment.

Goals or (Phases) - are short-term oriented and should be established whereby they can be measured by target dates or mileposts. In contrast to objectives which are normally long range and do not change as rapidly, goals are near term or short range. Goals should be related to a sub-objective or an objective.

Maintenance - minor changes (approximately three man months of effort) to an automated data system's computer programs essential to keep current with legal or management changes; i.e., payroll changes on income tax changes due to Federal, State or Local Government legal actions.

Management Information - is data that has been arranged in some predefined sequence or format from which management decisions are made.

Objective - a broad statement of policy which identifies organizational management needs to be met at some future date within the environment. Objectives do not provide detailed procedures for accomplishment.

Organizational Element - are departments, divisions, branches and sections which make up an organizational level.

Organizational Level - may be defined as federal, state, county, or local government, or it may be defined as corporations with regional, district and local offices.

Plan - a summary of actions required to implement the policies and objectives of an organization(s) with defined goals to be accomplished by target dates whereby progress can be measured.

Policy - a course of action identified by the top level executive of an organization and normally selected from alternatives presented to provide guidance for future decisions.

Process - a continuing course of action leading to the formulation of a plan; i.e., identify management information requirements, define resources, establish goals, etc.

Resources - personnel, time, computer hardware, software, dollars, materials, etc. which are used to meet top management requirements from a data processing perspective.

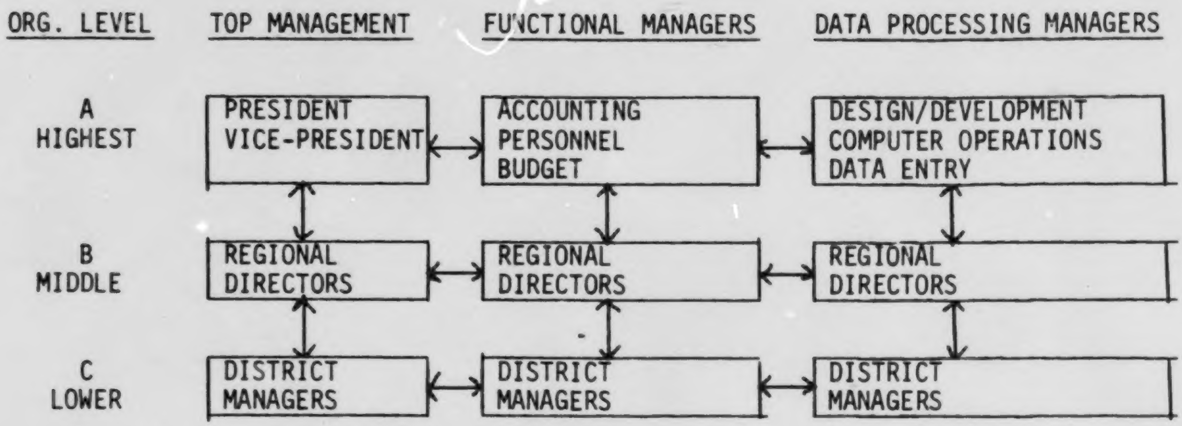
Responsibility - being accountable to perform certain activities. Responsibility normally infers authority for making decisions related to the functions for which we have been assigned responsibility within an organizational level.

Software - the computer programs which provide instructions to the computer hardware to govern its processing functions (i.e.,) operating system software. Applications software are computer programs used to process a function such as payroll, personnel, etc.

Sub-Objectives - where applicable, would be parts of an established objective, whereby it may take four or more sub-objectives to accomplish one main objective.

INFORMATION FLOW

Once clear communication has been established between organizations, the information essential to effectively manage all functions should be communicated from the highest to the lowest organization and organizational element. Each person responsible should be informed of the policies, objectives, and priorities for implementation. The chart below portrays the horizontal and vertical flow of information between organizational managers and between organizational levels.


ORG. LEVEL
TOP MANAGEMENT
FUNCTIONAL MANAGERS
DATA PROCESSING MANAGERS
A
HIGHEST
PRESIDENT
VICE-PRESIDENT
ACCOUNTING
PERSONNEL
BUDGET
DESIGN/DEVELOPMENT
COMPUTER OPERATIONS
DATA ENTRY
B
MIDDLE
REGIONAL DIRECTORS
REGIONAL DIRECTORS
REGIONAL DIRECTORS
C
LOWER
DISTRICT MANAGERS
DISTRICT MANAGERS
DISTRICT MANAGERS

The horizontal flow of information in the decision-making process closely parallels the responsibility of top management, functional managers and data processing managers. The information should flow from the top management to the functional managers to the data processing managers. At the same time, as information is being communicated horizontally to the functional managers and the data processing managers at the highest organizational level, it should be communicated vertically to the regional directors and district managers at the middle and lower organizational levels. This insures that top management at the three organizational levels are on the same frequency and are communicating in a clear, concise manner to the functional managers and to the data processing managers. Vertical and horizontal communication of information from top management is ideally portrayed in the above chart. The next step is to examine the roles of the different managers. The functions and responsibilities of the different levels of management at the three organizational levels are illustrated below.

TOP MANAGEMENT

ORGANIZATIONAL LEVELS: A —— B —— C

FUNCTIONS/RESPONSIBILITIES:

1. Define organizational policies.
2. Establish objectives.
3. Identify priorities of objectives.
4. Approve Master ADP Plan.
5. Allocate resources.
6. Monitor implementation.

FUNCTIONAL/MIDDLE MANAGEMENT

ORGANIZATIONAL LEVELS: A —— B —— C

FUNCTIONS/RESPONSIBILITIES:

1. Identify top management's objective and priorities.
2. Establish sub-objectives to implement objectives of top management.
3. Define, consolidate and coordinate management information requirements for the data processing managers.
4. Identify local management objectives and/or sub-objectives.
5. Coordinate and establish goals with the data processing managers.
6. Serve as a member of an implementation team.

DATA PROCESSING MANAGEMENT

ORGANIZATIONAL LEVELS: A —— B —— C

FUNCTIONS/RESPONSIBILITIES:

1. Analyze management information requirements to determine impact on resources.
2. Identify the functions to be performed by each data processing organizational level; i.e., analysis, design and development, computer operations, etc.
3. Prepare Master Automated Data Processing Plan.
4. Identify resources essential to implement objectives of top management in the Master Plan.
5. Forward Master ADP Plan to top management for approval. If approved, budget for resources to implement objectives.
6. Implement the plan in conjunction with functional managers.

Three organizational and management levels' functions and responsibilities are defined above, however, there must be a media for communicating and consolidating them into a long range data processing plan.

MEDIA - MANAGEMENT INFORMATION REQUIREMENT(S)

A media must be used to communicate management information requirements between the functional managers at the various organizations and the data processing manager(s). The coordination by the functional managers impacted is an effective means of insuring open and clear communication. This becomes a source document in support of the Master Automated Data Processing Plan. The content and format are:

HEADING: Organization Level(s) by Functional Area - Personnel, Accounting, Etc.

OBJECTIVE: Identify organization objectives to be supported by this requirement.

ORGANIZATION(S) PRIORITY: Specify each organizational level involved and priority of the objective established at highest organizational level.

TITLE: Descriptive title of automated data system, software or data processing equipment covered by the management information requirement.

CONCEPTUAL DESCRIPTION OF REQUIREMENTS OR CAPABILITIES DESIRED: The user should describe in narrative non-technical language, the functions to be performed or the capabilities desired to manage the function. Information should include source of data, method used to collect the data, the volume if known, the flow of information from point of origin to final disposition plus action or responsibility of each organizational element involved. Include as much information as possible that may be useful to a Systems Analyst in applying current computer technology.

JUSTIFICATION: Identify the benefits, tangible or intangible.

DESIRED IMPLEMENTATION DATE: Indicate the desired implementation date.

ORIGINATOR:____________________

COORDINATION BY FUNCTIONAL MANAGERS:

ORG. LEVEL C:____________________

ORG. LEVEL B:____________________

ORG. LEVEL A:____________________

APPROVAL BY TOP FUNCTIONAL MANAGER:__________________________________

MEDIA - MASTER AUTOMATED DATA PROCESSING PLAN

A Master Plan may be prepared for each organizational level or consolidated at the highest organizational level to include a clear understanding of the policies, objectives and goals of all organizational levels and elements.

Responsibilities or mode of operation of the Data Processing Organizational Element; i.e., Centralized Design and Development of Automated Data Systems, Decentralized Computer Operations or a form of Distributive Data Processing should be clearly defined.

The Master Automated Data Processing Plan should cover the current year plus five years' management objectives, requirements, resources and goals/phases to meet the organization(s) objectives in the priority sequence established by top management. Updating the plan annually involves a continuous process of collecting changes to management objectives and information requirements to reflect the changes that have occurred. This is a refining process because five years' projections are primarily estimates and need an annual review.

The Master ADP Plan consists of three parts:

Part I - Overall Management Summary - Current and Projected Requirements

Part II - Current Operational Automated Data Systems Requirements

The format for Part I and Part II would be similar with Part I having General Information, Current ADP Environment, and Technological Forecast which need not be duplicated under Part II. The format, except as defined in the prior sentence, is:

HEADING: Title, organization, coverage

IDENTIFICATION: Part I or II as applicable.

GENERAL INFORMATION: Describe the mission of the overall organization(s) and functions supported by the Data Processing Organizational Element.

SCOPE: This part of the Master ADP Plan defines resources essential to meet all defined management information requirements current and projected for 1980-1985.

CURRENT ADP ENVIRONMENT: Describes capability, capacity of the data processing resources and any assumptions used in the Plan.

TECHNOLOGICAL FORECAST: Include a long range forecast of future technological developments covering hardware (micro, minis, etc.), software and communications.

OBJECTIVES: List all objectives of organizations by priority which are to be supported by the applicable Data Processing Organizational Element.

ASSUMPTIONS: List any assumptions used to cover this plan.

CONSTRAINTS/LIMITING FACTORS: Identify all limiting factors that may preclude meeting the established goals and/or objectives.

RESOURCE AND COSTS: Include resources essential to support current and/or projected management information requirements.

	CURRENT YEAR	1981	1982	1983	1984	1985
Personnel Required	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Personnel Costs	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Data Processing Equipment	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Software	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Communications	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Site or Site Modifications	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Operating Expenses & Supplies	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
TOTAL ESTIMATED COSTS (THOUSANDS)	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

Part III - Future Requirements by Automated Data Systems. A Part III is prepared for each function using data processing resources. It may include maintenance of existing systems, development of a new system, acquisition of a new computer, new software, site modifications, etc. The detailed Part III's summarizes all functional areas requirements and resources into Part II and I. The format for Part III includes:

HEADING: Organization(s) and Functional Area (Accounting, Personnel, Etc.)

IDENTIFICATION: Part III - Future Requirements by Automated Data Systems

AUTOMATED DATA SYSTEM TITLE: Enter the descriptive title of the automated data system that is to be designed, redesigned or modified and additional resources.

OBJECTIVE(S) AND/OR SUB-OBJECTIVES PLUS PRIORITIES: Identify the objectives, sub-objectives by organizational level and priorities established by the applicable organizational level and element.

GOALS OR PHASES: Define each goal or phase essential to implement the action on the automated data system to meet the established objectives. Examples of some goals or phases are:

- . Analyze/define management information requirements - Oct-Dec 1980
- . Resource impact analysis to identify additional resources required - Jan-Mar 1981
- . Obtain approval of Master Plan - May-June 1981
- . Prepare user specifications & systems design specifications - July-Sept 1981
- . Program, systems test and implement new/redesigned system - Jan-Sept 1982

JUSTIFICATION: Enter the justification for the management information requirement provided and approved by the functional managers.

ADDITIONAL RESOURCE REQUIRED: Identify the type of resources needed by year and costs.

	CURRENT YEAR	1981	1982	1983	1984	1985
Personnel	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Personnel Costs	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
Data Processing Equipment (5 CRT's)	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX
TOTAL ESTIMATED COSTS	XXXX	XXXX	XXXX	XXXX	XXXX	XXXX

SUMMARY

Many articles have been written about improving productivity of data processing activities from computer performance measurement to programmer productivity. Personnel costs of data processing installations (medium to large) have risen continually over the years to approximately 60-70% of the total data processing installation. On the other hand, hardware costs have decreased.

Computerworld, Datamation, and other professional publications have published articles over the past years which indicate that 60-70% of systems analyst/programmer's time is spent making changes to existing systems. The IN DEPTH report in September 15, 1980 Computerworld on "The Personnel Crunch" by Harold S. Bott stated: "Over a five year cycle, 67% of the total effort in developing a system is maintenance programming."

A team or participatory management approach to establishing policies, objectives and priorities whereby information is communicated to all levels as a Master ADP Plan eliminates fragmentation of effort and maximizes the efficient utilization of resources. A reduction of 25-50% of systems analyst/programmer time used in maintenance would free up personnel for more productive efforts. While there may not be a method to quantify the enhanced productivity, in terms of hours or dollars, the managers would have a roadmap to guide them. Managers could apply their time and efforts to solving management problems while technicians perform the operating tasks.

Every person involved has a role as a member of a team involved in winning the game for the organization(s). Peter F. Drucker (Management, 1973) stated, "If objectives are only good intentions, they are worthless. They must degenerate into work. And work is always specific, always has--or should have--clear, unambiguous, measurable results, a deadline and a specific assignment of accountability." A long range Master Automated Data Processing Plan based on the concept described in this paper follows that principle.

ACKNOWLEDGEMENT OF RESOURCE MATERIALS

Computer Dictionary and Handbook, First Edition, Third Printing 1967, Charles J. Sippl.

A Datapro Feature Report - Glossary of EDP Terms, October 1976.

Harvard Business Review - January 1974.

Management Magazine, 1973.

USAF Air Force Accounting and Finance Center's Objectives Plan and Program, April 1980.

Proceedings - Ninth Annual Seminar for Academic Computing Services, August 14-16, 1978.

The Bible, Genesis, Chapter II, Verse 7.

IMUR
AN INTERACTIVE MODEL OF UNIVERSITY RESOURCES: INTEGRATING DATA FROM VARIOUS MANAGEMENT INFORMATION SYSTEMS

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Sophisticated planning models and management information systems have been readily available to higher education decision makers for several years. Yet recent articles bemoan the lack of more rapid acceptance and use of these tools by administrators despite the fact that declining enrollments and inflation should have increased the demand for higher education planning efforts and decision-influencing information. An alternative approach involves the use of a relatively simple model to stimulate dialog among administrators, planners, and researchers and to subsequently focus more sophisticated follow-up modeling and information system design efforts. This paper describes an interactive computer model which relates the variables surrounding decisions involving faculty, funding and enrollments. The use of the model to integrate information from disparate information systems will be discussed as well as the theory, operation and data requirements of the model.

IMUR

AN INTERACTIVE MODEL OF UNIVERSITY RESOURCES: INTEGRATING DATA FROM VARIOUS MANAGEMENT INFORMATION SYSTEMS

Sophisticated planning models and management information systems have been readily available to higher education decision makers for several years. Yet recent articles bemoan the lack of more rapid acceptance and use of these tools by administrators despite the fact that declining enrollment and inflation should have increased the demands for higher education planning efforts. Among the reasons advanced for the slow adoption of planning models are:

1. the models have been too simple (imprecise results, tenuous assumptions);
2. the models have been too complex (massive support data, incomprehensible logic);
3. the question to be addressed by the model has been poorly defined;
4. higher education administrators have relatively high turnover;
5. administrators have been uneasy with quantitative methods; and
6. political management of the model development has been poor (overly exuberant promotion of the model's capabilities, premature release of the results).

The specification and development of management information systems have been hampered by many of these same problems plus expense, long lead times, and the lack of integration of existing operational systems.

An appropriately selected planning model can be used to alleviate some of the aforementioned problems. The question to be addressed by the model must be central to the operation of the university so that the results will be of interest to a diverse group of administrators. The theory behind the first iteration of the model must be simple so as to inspire the confidence of those who are not at ease using models. If appropriately managed, this first use of the model should lead to more sophisticated follow-up modeling efforts. The data selected to support the model and the administrators' conceptualization of the relationships between these data should also be of value to management information systems designers and data administrators. This paper will discuss the development of a specific interactive computer model at the University of Kansas and its potential to promote administrative involvement in sophisticated model development and design of management information systems.

WHY WAS A MODEL DEVELOPED?

In the spring of 1976 it became clear to the administration of the College of Liberal Arts and Sciences that declining enrollments in departments in which a large proportion of the faculty held tenure could be a significant problem in the near future. Was sufficient staffing and funding flexibility available to deal with potential significant drops in demand for the services of some faculty and significant increases in demand for others? A team composed of a college associate dean (mathematics), a faculty member (economics) and two institutional researchers (M.B.A.s) was formed to examine this issue.

The team decided to develop a computer-based model which would provide administrators with a hands-on tool for analyzing the interaction of predicted enrollments with alternative staff, workload and funding policies. Called IMUR, Interactive Model of University Resources, the multiyear model would be based on the assumption that students will demand a certain number of credit hours in various disciplines. It is the challenge of the university constrained by available faculty, teaching loads, funding and tenure to meet this demand.

BUILDING A MODEL

In developing a model several considerations are paramount. Some questions to ask include:

1. What is the purpose of the model and what kind of questions are to be answered?
2. What levels of detail and precision are required to respond to the questions and to insure confidence in the results?
3. How flexible must the model be to deal with new questions, data and relationships?
4. What data are available to support the model?
5. Who will be involved in defining the model and who will make the final decisions about the content and operation of the model?

It is not coincidental that these questions are similar to those that should be asked when undertaking development of a management information system.

With these considerations in mind, the team determined that one important output of the model would be a display of the student credit hours (SCH) demanded by students versus the supply of SCH available given the existing number of faculty and established teaching loads. Another key output of the model would be the comparison of faculty salary funding with salary costs. The ability to vary number of faculty, faculty workloads, funding assumptions and cost assumptions each year was an essential requirement of the model to allow exploration of alternative policies. To meet the test of flexibility, the model would be constructed from modules which could be changed or updated individually without destroying the integrity of the rest of the model.

Where feasible, the team selected traditional parameters and used historical data patterns to develop the model. The selected parameters included such items as four course levels of instruction (lower level undergraduate, upper level undergraduate, master's and doctoral); four types of faculty (tenured faculty, tenure-track {probationary} faculty, student teaching assistants, and all other, such as lecturers and instructors); and average faculty salaries by discipline by faculty type. Two areas which were discussed extensively were: 1) at what level of aggregation should instruction be analyzed, and 2) how will faculty effort and SCH be linked to determine faculty teaching loads.

There has been much debate about the level of aggregation at which instruction can be meaningfully analyzed. The model was developed at the discipline rather than the departmental level. The Higher Education General Information Survey (HEGIS) taxonomy was used to aggregate departments into such disciplines as social sciences, physical sciences, education, etc. It was argued that these aggregations were sufficient for discerning trends and that the departmental enrollment trends within a discipline would be similar. However, budget, tenure and other decisions are made at the department level, not at the discipline level. Small departments are special problems in that small numbers can confound meaningful projections. Data are now being gathered which will enable the model to operate at the departmental level also.

Determining faculty teaching loads has been the most difficult task in developing the model. The inability to allocate faculty effort to courses has long been the stumbling block to cost analysis in higher education. Initially a Faculty Activity Analysis (FAA) was used. In the FAA, faculty reported their effort for individual courses and then an average course load (SCH per FTE) was calculated by course level and by department/discipline. However, since the University of Kansas does not conduct a FAA on a regular basis (the latest available figures are for 1974), this was found to be an inadequate solution. Eventually a standard course weighting system was used to allocate faculty effort to courses. The weighting system considers type of class (lecture, lab, individual research, activity, etc.) class size, course level, credit hours, and contact hours.

DATA TO SUPPORT THE MODEL

After defining the basic operation of the model and cursorily identifying the data to be included in the model, the team began to define the precise data needed and locate an appropriate source of these data. This was not an easy task because of the state of the administrative information systems at that stage in the project. The university was in the process of converting all its administrative systems from hardware shared with academic computing to separate hardware and software of another vendor. The student credit hour information (SCH demand, teaching loads) was located on the new administrative computer while the financial data (faculty salaries and FTE) were located on the academic computer.

To further compound the problem, even data common to the two systems were not always consistent. The primary reason for these inconsistencies was that data in each system were defined and updated solely for the operational use of a specific user. Also the systems were developed at different times during an eight-year span with the attendant changes in personnel, system requirements, and information systems state of the art.

An interim solution to meet the data requirements of the model and other analytical efforts was obviously necessary while a longer term data administration effort was undertaken. The interim solution agreed upon involves taking extracts of key data in the personnel/payroll, student records, and other data bases and files at specified times each semester and storing these on tape. In some cases manipulation of these data were necessary before storage on tape to assure comparability of data from different systems and/or years. The possibility of bringing much of these data together in a summary data base on disk is being explored.

CURRENT STATUS OF IMUR

Figure 1 outlines the basic operation of IMUR. When beginning a simulation with the model, the user must select policies and assumptions from displayed menus such as enrollment projection technique, inflation rates, and faculty attrition rate. These policies are in effect for all years of the specific simulation session. At this point the user can choose the "manual" or "automatic" mode. In the manual mode the user can vary the mix of faculty and workloads for each discipline for each year. In the automatic mode the user can choose whether the model will adjust faculty mix or workload to balance SCH supply to demand. In either mode a variety of summary displays can be selected for each year.

Figure 2 displays a simplified version of the basic program algorithm for each discipline for a single year. The key comparisons are SCH supply versus demand and salary costs versus funding. An important contributor to the flexibility of the model is the faculty FTE change matrix. It is relatively easy to include any number of new matrices which may be discontinuous functions (e.g., actual retirements) or linear functions (e.g., attrition rates). Also all automatic and manual adjustments of faculty mix are made through a change matrix. The data required to drive the model include historic SCH, faculty salaries, faculty FTE, faculty workloads, faculty effort allocations, funding formula, faculty attrition, faculty retirements, and tenure rates.

In its current configuration, the model takes the selected enrollment projection, funding alternative, and inflation assumptions; the historic changes to faculty mix; the calculated faculty allocation and workloads; and

FIGURE 1. IMUR - BASIC OUTLINE OF THE MODEL

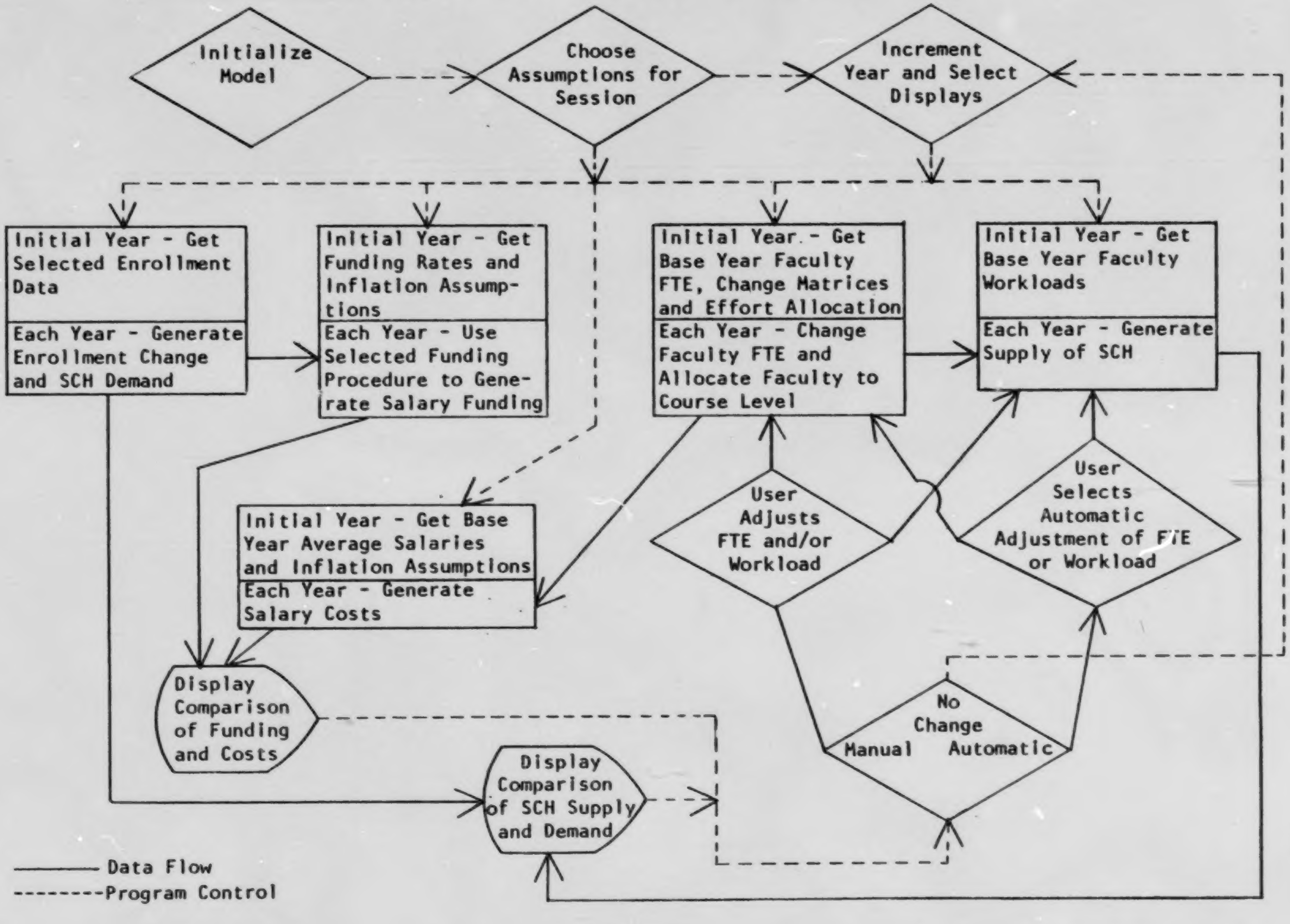
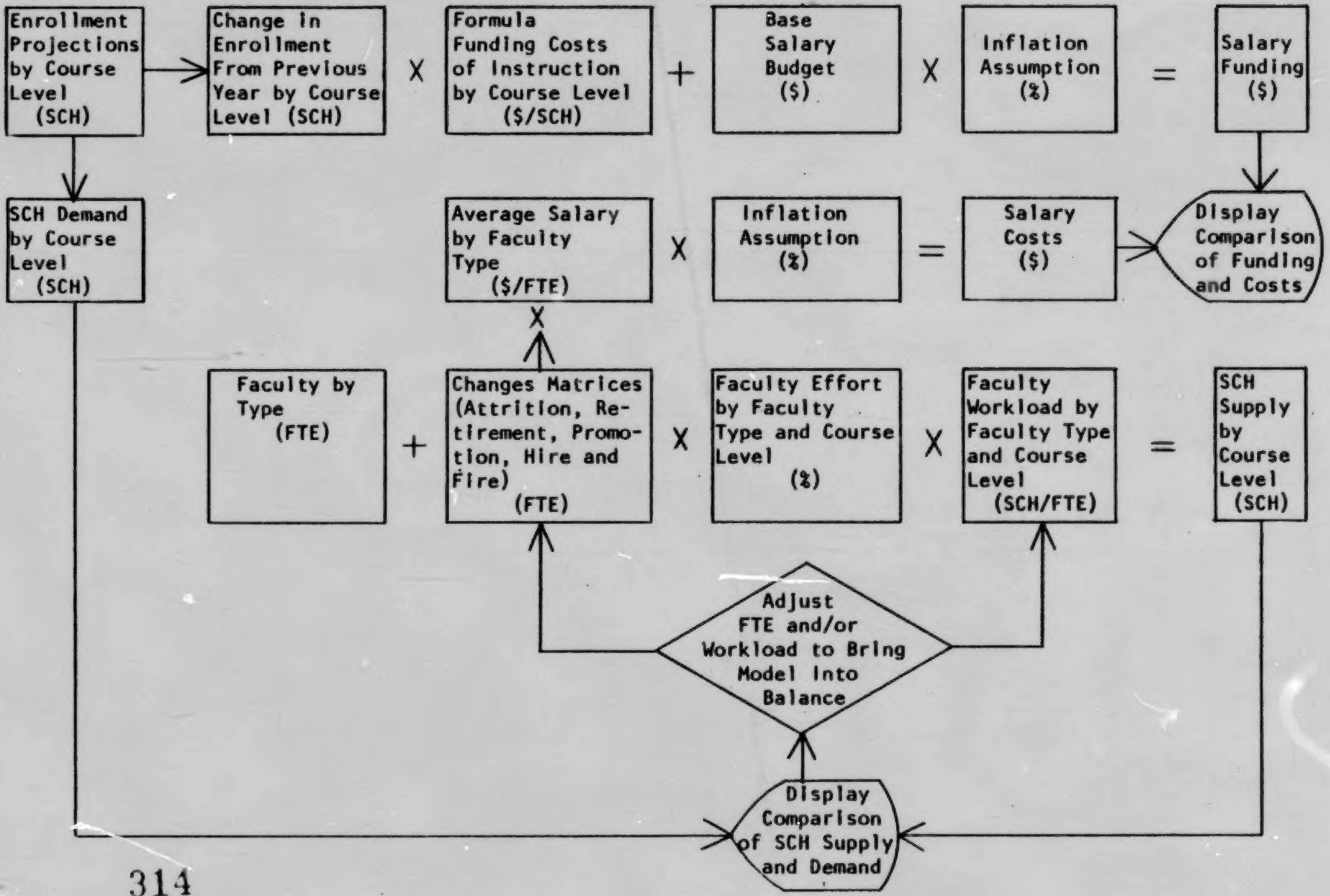

Initialize Model
Choose Assumptions for Session
Increment Year and Select Displays
Initial Year - Get Selected Enrollment Data
Each Year - Generate Enrollment Change and SCH Demand
Initial Year - Get Funding Rates and Inflation Assumptions
Each Year - Use Selected Funding Procedure to Generate Salary Funding
Initial Year - Get Base Year Faculty FTE, Change Matrices and Effort Allocation
Each Year - Change Faculty FTE and Allocate Faculty to Course Level
Initial Year - Get Base Year Faculty Workloads
Each Year - Generate Supply of SCH
Initial Year - Get Base Year Average Salaries and Inflation Assumptions
Each Year - Generate Salary Costs
User Adjusts FTE and/or Workload
User Selects Automatic Adjustment of FTE or Workload
No Change
Manual
Automatic
Display Comparison of Funding and Costs
Display Comparison of SCH Supply and Demand
Data Flow
Program Control

FIGURE 2. IMUR - BASIC ALGORITHM FOR ONE DISCIPLINE FOR A SINGLE YEAR


Enrollment Projections by Course Level (SCH)
Change in Enrollment From Previous Year by Course Level (SCH)
X
Formula Funding Costs of Instruction by Course Level ($/SCH)
+
Base Salary Budget ($)
X
Inflation Assumption (%)
=
Salary Funding ($)
SCH Demand by Course Level (SCH)
Average Salary by Faculty Type ($/FTE)
X
Inflation Assumption (%)
=
Salary Costs ($)
Display Comparison of Funding and Costs
X
Faculty by Type (FTE)
+
Changes Matrices (Attrition, Retirement, Promotion, Hire and Fire) (FTE)
X
Faculty Effort by Faculty Type and Course Level (%)
X
Faculty Workload by Faculty Type and Course Level (SCH/FTE)
=
SCH Supply by Course Level (SCH)
Adjust FTE and/or Workload to Bring Model Into Balance
Display Comparison of SCH Supply and Demand

the FY 1978 average salaries and base salary budgets and then projects faculty mix, faculty workloads, SCH supply and demand, salary funding and salary costs by discipline. The model currently uses FY 1978 as the base year and includes actual SCH and inflationary increases for FY 1979 and FY 1980. The model projects five years, FY 1981 to FY 1985.

NEXT STEPS

Our experience with the model to date leads us to feel that a major decision with respect to the operation of the model will have to be made soon. As the model has grown in complexity, the amount of time necessary to complete one modeling session has increased significantly. It is highly probable that use of the model by administrators will decrease if the session times increase further. The dilemma we face involves our desire to maintain a "hands-on" capability for those who desire it while increasing the level of model detail.

Reducing the number of display choices, making more of the matrices into precalculated files, using higher speed CRTs and modems, and reducing the scope of each modeling session (one discipline or department at a time) would enhance the speed of the model. However, these gains would be more than offset by the addition of beneficial but time-consuming capabilities such as linear programming solutions or the addition of major new variables such as support staff, other operating expenses, and floor space. The ultimate solution may be two models: one simple model for administrators which operates at relatively high degrees of aggregation, and a second model which would be used by institutional researchers at the direction of administrators to model more disaggregated data with more sophisticated techniques. The use of commercially available packages such as EDOCOM's Financial Planning Model (EFPM) and other more general data managers and modeling languages is being explored.

We anticipate that IMUR will be successful in addressing the specific question responsible for its creation: Does the University of Kansas have sufficient staffing and financial flexibility to meet anticipated enrollment changes? Yet the ultimate value of the model may not be its projections related to this specific question. If IMUR and any successor models can be kept simple in concept and user-friendly in computer implementation, we can encourage use by new administrators and those less quantitatively oriented. As these administrators gain experience in the use of computer-based planning models, we can expect that they will be better able to specify and communicate their information needs to management information system designers. The dialog established during the specification, design and first use of both management information systems and sophisticated planning models should provide the impetus for a productive and on-going discussion of the present and future policies, plans and information needs of the institution.

TRACK V
GREAT APPLICATIONS

Coordinator:
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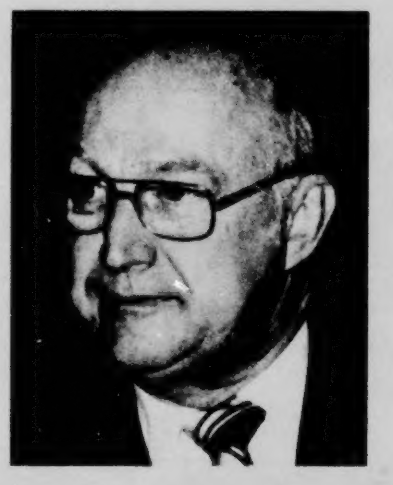
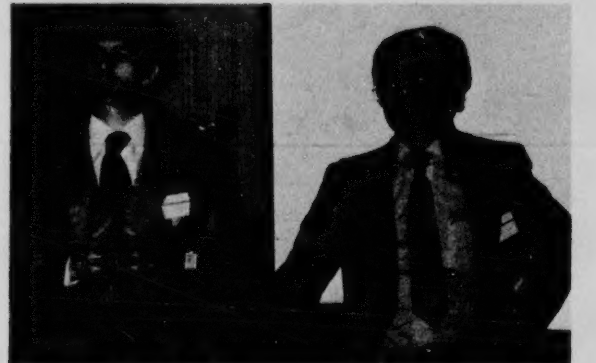


J. P. McGuire
State University System/Florida

Donald L. Myers
University of Northern Colorado



Tony Barnfather *Fred Rosmanitz*
University of Calgary

STANFORD UNIVERSITY'S
TERMINAL FOR MANAGERS PROGRAM

by

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Deputy Director of Administrative Information Systems
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STANFORD UNIVERSITY'S
TERMINALS FOR MANAGERS PROGRAM

> *A Stanford University administrator, 3,000 miles away from home, places a call to Stanford's computer center from his hotel room and logs his terminal onto the system. He then proceeds to examine the day's mail, sends some instructions to his secretary, writes a short note to a colleague, and checks the status of two key projects.*
>
> *An administrative assistant sends the minutes of a decision oriented meeting to each participant as well as other parties. Each recipient has the information available for examination and use within 30 minutes of the meeting.*
>
> *A manager examines twelve messages, responds to seven, and initiates four others, all during a 25 minute period of time. None of the individuals with whom he has been "conversing" have been available by telephone.*
>
> *A member of a project team has been working most of the night using a terminal located in her home. Before going to bed for some much needed rest, she leaves status information for the project leader and sends key data to other project members who will be working on related components while she sleeps.*

The above examples are extracted from the literally hundreds of case of use of the services provided by Stanford's new Terminals fo Managers program. This program is intended to introduce suc technology into the executive and senior offices of the university As a part of this experiment, terminals are located in the offices o the President, the Vice Presidents, University Counsel, and more tha 50 other principal officers at Stanford.

The remainder of this paper describes the program, the service offered by it, some early experiences, some preliminary conclusions and plans for the future.

INTRODUCTION

The Terminals for Managers program was undertaken with two primary objectives in mind. One is quite specific: Create a Decision Support System which will demonstrate the functional, technical, and economic value of features like electronic mail and other related information technology services for University administrators. The other is more general; educate these executives in information technology and systems. This second objective is working even better than expected. The technology that has been presented and built upon is not new. What is new is the willingness of managers to adapt that technology into their daily routine.

In creating a Decision Support System, the project team targeted four goals.

The first is to provide support in the improvement of the communication process. Several studies have already shown that nearly 75% of all attempts to establish communication via the telephone are unsuccessful on the first try - and nearly 50% are unsuccesful on the second try. To the extent that the Decision Support System is used, this syndrome, commonly called "telephone-tag", is to be eliminated. Furthermore, the system is to support instant delivery of messages as well as instant retrieval and access of messages, and to reduce, if not to eliminate, the barriers of geography and time (and time zones) to personal communication.

A second goal is to provide for the personal use of the computer for problem solving in the office environment. Because of the extremely wide diversity of problem types and solution oriented tools, an initial decision was made to provide for a common environment for the access of these tools first. Installation of the specific tools would occur in a second step.

A third goal is to be able to support a wide variety of office management arrangements. The team is well aware that offices organize themselves both around the individual personalities involved and in support of the specific tasks to be accomplished in those offices. It is clear that any attempt to "force fit" a particular office arrangement is doomed to failure. The Decision Support System has to be flexible enough to support a wide variety of office arrangements.

A fourth goal is to create a system which is user friendly and user helpful enough to support and encourage its use among a group with minimum incentive to otherwise make use of the system.

THE DECISION SUPPORT SYSTEM

The project team has designed a Decision Support System which contains in its initial offering, four primary components. The Electronic Message System is perhaps the key element; it is the most visible and the most easily understood. Electronic messages combine the impact of a phone call with the clarity - or deliberate vagueness - of a memo.

The Text Preparation component is an obvious and necessary piece of the initial offering. The Electronic Filing System allows for both the filing and subsequent retrieval of electronic messages. Finally, the Electronic Reminder System was deemed to be an extremely important component. Each of these components is discussed in more detail below.

Figure 1 presents a model which indicates the relationships between the four components.

Messages flow from the "in-basket" to the participant's terminal upon request. The back-arrow indicates that messages may be left or replaced in the in-basket for later examination. Outgoing messages are sent from the participant's terminal to an "out-basket". Replies to incoming messages are handled in much the same way. (In reality there is no electronic out-basket. Original messages, or replies to incoming messages, are placed immediately in the electronic in-baskets of the designated recipients. This satisfies the 'instant delivery' requirement.)

Continuing clockwise around the diagram one can see that messages (either received or sent) may be printed. This can occur either in the office on local terminal-like printers or at the central facility. Messages may also be deleted at any time. A fail-safe mechanism is built into the Decision Support software so that deleted messages are not actually removed from the system immediately but are retained for an additional 48 hours. Deleted messages which have not yet been removed are available for retrieval.

Messages may be indexed, filed and subsequently retrieved. Messages may also be filed so they will be brought to the attention of the participant at some specified future time.

The Electronic Message System

The Electronic Message System provides a wide variety of options. One may send messages. Included here are such features as carbon copy to one or more recipients, optional printing, default chronological filing, positive notication of message receipt, optional entry into the reminder system, and so on.

One may also browse through incoming messages. This is equivalent to flipping through the contents of an in-basket. Browsing an in-basket provides an ordered list of messages with information like sender name and identifier, day and date and time, and message subject and length.

The system user may, of course, read messages. Messages may be read individually by selecting specific items or by examining the contents of the in-basket in sequence. After a message has been presented to the system user, she may choose to exercise a variety of actions such as: reply, forward, print, file, delete, reminder, and so on.

DECISION SUPPORT SYSTEM OVERVIEW

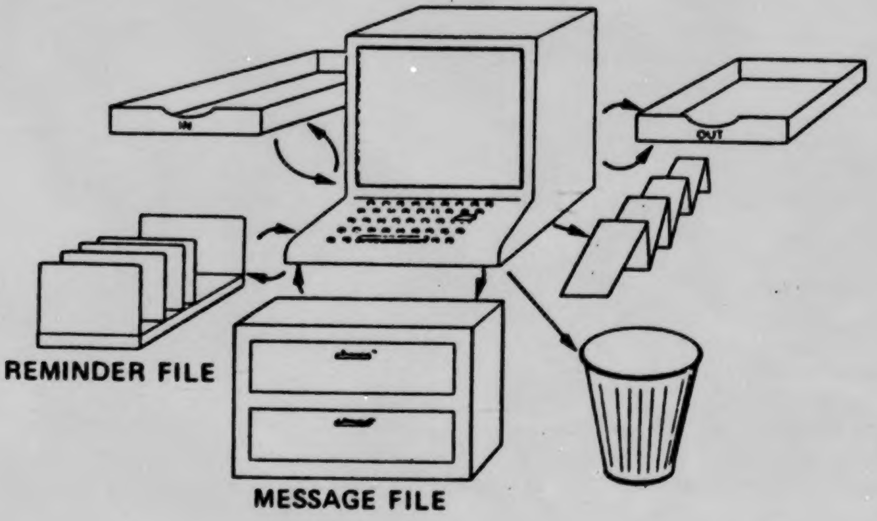

IN
OUT
REMINDER FILE
MESSAGE FILE

FIGURE 1

Another major feature of the Electronic Message System is the electronic directory. The directory performs several supportive functions. It translates three-letter initials into specific computer account identifiers and interactively resolves duplication with the message sender. It provides a "who" function to allow for the lookup of individuals by either initials, name, or computer account identifier. Finally, it supports a "distribution list" function. Participants who send messages regularly to groups of system users may define a distribution list. The name of this list may be used instead of entering all the identifiers each time a message is to be sent to that group.

Also, hard-copy output options are available as a part of the message system. Hard-copy may be directed to local printing terminals or word processors or to the central printer attached directly to the computer.

The Electronic Filing System

The electronic filing system is an important and powerful component of the Decision Support System. Any message which is filed electronically is automatically indexed by the receiver, the sender, the date, and each word in the subject. In addition specific keywords may be added to aid in subsequent retrieval. The retrieval of messages is accomplished through simple English like expressions in which any index or combin ation of indices may be used.

The Electronic Reminder System

The Electronic Reminder System accepts a message for subsequent automatic retrieval. Any message may be sent to the reminder system with an indication that it is to be brought back to the sender's attention either on a specified date or after some specified number of days has elapsed.

Text Preparation System

Text preparation, as a part of the Decision Support System, is accomplished in a variety of ways. The basic editor for entry of messages is the WYLBUR line editor. Word processors equipped with communications facilities may also be used as entry and message sending devices. In addition, SCRIPT is available for the preparation of long documents. A very high speed laser printer which includes definitions for nearly 100 different print fonts may be used for output at the central facility.

INSTALLATION

After nearly two years of technically-oriented experimentation with electronic message systems and other support software, a proposal was presented to the Vice Presidential group in early 1980. The proposal suggested the establishment of a Terminals for Managers program as a one-year experiment. The Vice Presidents not only agreed to support the program but to use the facility as well. The project team was formed and developed the software, documentation, training program, and beta-test in the next four months. Installation of the system began in the late summer.

The project team knew that the installation of a system of this kind in a widely dispersed environment had to be as carefully planned as the software itself. Several important principals and guidelines were established to guide the development and installation of the system.

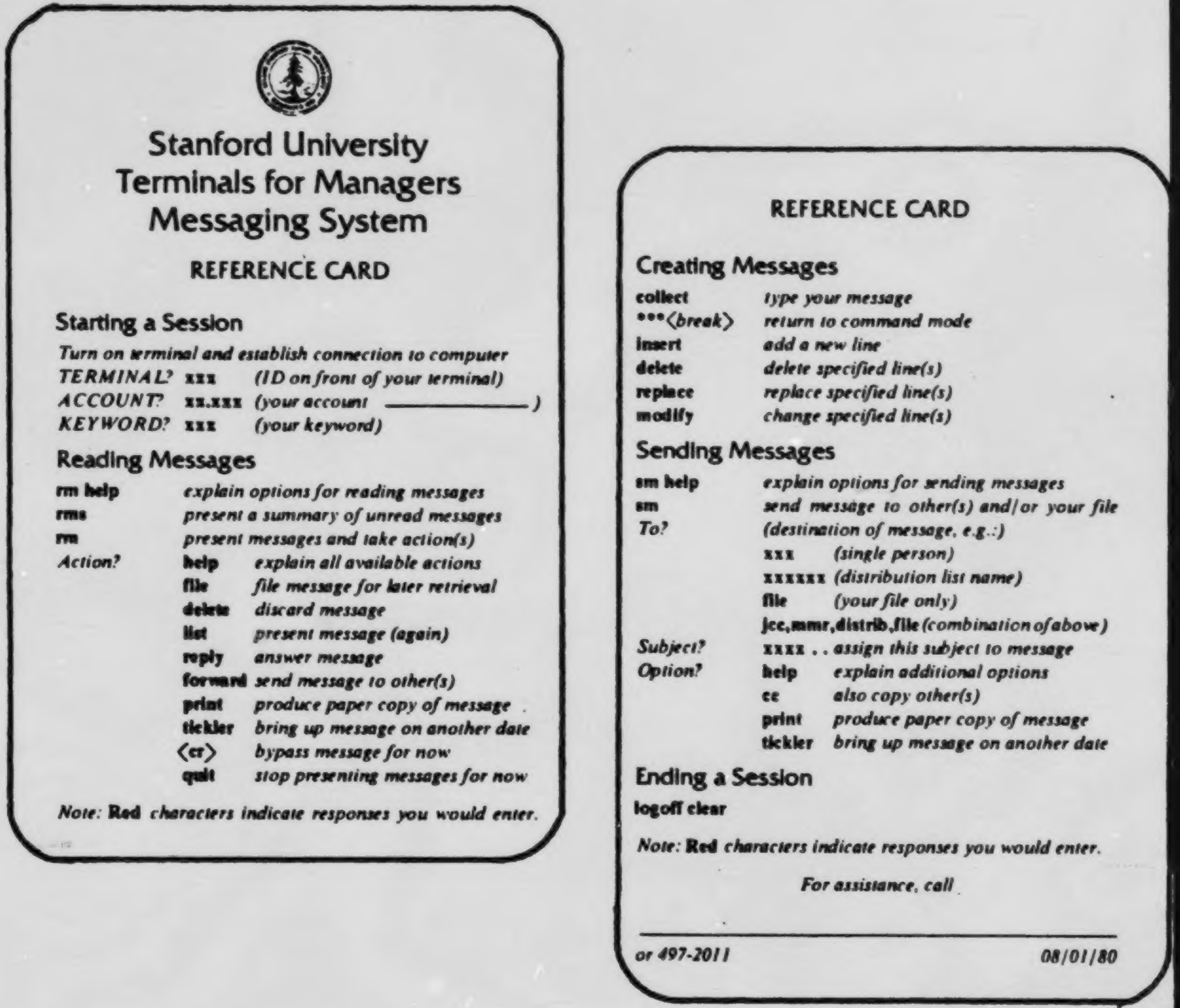
For designing a "user friendly and user helpful" system the DWIM (Do What I Mean) or Principle of Least Surprise guideline has been established. The intent is to insulate the user from as much computer-oriented jargon as possible and to create a system which will behave predictably and allow for correction of mistakes. The team has also been extremely sensitive to the amount of time which the proposed users can spare. Thus, one-on-one training sessions were planned and conducted in user offices and at their own terminals.

Several levels of documentation are provided. A manual, which ends up spending most of its time on the users' shelves, is given to each participant. Of more use is a double-sided, pocket-sized card which contains a very brief synopsis of the four components. (The card is shown in figure 2.) Most important is a complete on-line help feature built directly into the Decision Support System. Help features are available not only as a general guide to the use of the system, but are also available at every prompt within the system. If at any point during the use of the system a participant is confused as to the appropriate response, she or he may request additional information.

The project team also feels that many of the prospective users of the system might have two serious concerns which could prove to be difficult barriers to overcome. On the one hand, the team feels that many of the administrators might be afraid that mistakes made by them in the use of the system could inadvertently destroy important information elsewhere. On the other hand, there is some reason to believe that many administrators might also be afraid of looking foolish. As an aid to overcome these worries, the project team provided both direct education and a means to use the system for fun in addition to work. Game playing has been provided as a method to allow users to become familiar with the use of terminals and connection procedures. As hoped, many new users became quite adept in the use of the terminal and systems through the use of such aids as Star Trek, Adventure, Solitare, Blackjack, and others. And as expected, participation in these games dropped off rapidly as use of the system for more work-oriented purposes began to rise.

EVALUATION

In order to provide objective analysis of the successes and problems associated with the system, an independent, multi-disciplinary



Stanford University
Terminals for Managers
Messaging System

REFERENCE CARD

Starting a Session

Turn on terminal and establish connection to computer

TERMINAL?	**xxx**	*(ID on front of your terminal)*
ACCOUNT?	**xx.xxx**	*(your account ______________)*
KEYWORD?	**xxx**	*(your keyword)*

Reading Messages

rm help	*explain options for reading messages*	
rms	*present a summary of unread messages*	
rm	*present messages and take action(s)*	
Action?	**help**	*explain all available actions*
	file	*file message for later retrieval*
	delete	*discard message*
	list	*present message (again)*
	reply	*answer message*
	forward	*send message to other(s)*
	print	*produce paper copy of message*
	tickler	*bring up message on another date*
	⟨cr⟩	*bypass message for now*
	quit	*stop presenting messages for now*

Note: **Red** *characters indicate responses you would enter.*

REFERENCE CARD

Creating Messages

collect	*type your message*
********⟨break⟩*	*return to command mode*
insert	*add a new line*
delete	*delete specified line(s)*
replace	*replace specified line(s)*
modify	*change specified line(s)*

Sending Messages

sm help	*explain options for sending messages*	
sm	*send message to other(s) and/or your file*	
To?	*(destination of message, e.g.:)*	
	xxx	*(single person)*
	xxxxxx	*(distribution list name)*
	file	*(your file only)*
	jcc,mmr,distrib,file	*(combination of above)*
Subject?	**xxxx . .**	*assign this subject to message*
Option?	**help**	*explain additional options*
	cc	*also copy other(s)*
	print	*produce paper copy of message*
	tickler	*bring up message on another date*

Ending a Session

logoff clear

Note: **Red** *characters indicate responses you would enter.*

For assistance, call

or 497-2011 *08/01/80*

FIGURE 2

evaluation team was formed from such departments as Anthropology, Education, Communication, and Engineering. That group is still in the process of preparing their first report; formal results are not yet available. There are, however, several indicators relating to user feelings about the system which are presented here.

It is important to note that the experiment, as originally defined, was intended to support approximately 55 individuals. ("Support" means both technical and financial support is provided to this set of users. They are provided with the terminal, the line, and the Decision Support System at no cost during the one-year experiment.) Very early in the life of the experiment those already defined as part of the program nominated others to be included. This raised the number of individuals supported to approximately 85. Of more significance, however, is the fact that there are 350 participants in the program as of this writing. The other 250+ users are all financially self-supporting. We think that this "bandwagon" effect is a most important indicator of the Decision Support System's viability.

Another positive indicator is that the number of messages being sent, per participant, has been rising steadily since the system's inception. Although there is a wide range of use depending upon the individuals involved, a frequency distribution of messages sent indicates a shift from the early average of four messages per day per individual toward ten or more messages per day per individual.

THE FUTURE

The original experiment is entering in its second phase and the project team is working on several additional objectives. For one, the team will attempt to extend the education and skills already provided to this particular community. It is considered extremely important to continue to build upon the base which has been established.

For another, the team will help specific users with specialized data bases. A beta-test Project Status/Reporting file has already been completed and given to the requesting user for test. Other, more generalized data bases, such as a Capital Budget file and a Legislative Bills file have also been developed and installed.

A third objective is to replace the current software. The present system was built as a prototype using the SPIRES data base system as the primary development tool. This allowed for very rapid development of the facility but has introduced several expensive inefficiencies. The development of a newer, production oriented system with a performance improvment of four or five to one is now under way.

From a different perspective, it is considered highly important to extend the Decision Support System, especially the Electronic Message System, to more than one host computer at Stanford. It is clear to the team that isolated or competing message and text facilities without interconnection could lead to outrageous outcomes like the necessity for more than one terminal in a particular office to access different systems providing similar, but non-communicating functions.

Finally, it is extremely clear that the Decision Support facilities of the system must be extended. This will require that specialized tools to support such areas as financial modeling, long range planning, budgeting, statistical analysis, and so on, be acquired, packaged, tailored, and completely installed.

FINAL COMMENTS

The team, and others in the Center for Information Technology, have received many comments, most of them positive, regarding the present system and its impact upon those who are using it. But perhaps the most telling one was that from a very senior administrator, in which, after telling the group the six or seven items which "clearly" needed fixing, he said,

> "...but if anyone wants to take my terminal away from me,
> he will have to meet me at 'High Noon'".

IMPROVING REGISTRATION PRODUCTIVITY - A NEW ALTERNATIVE

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The State University System of Florida has developed an on-line registration system in a distributed environment utilizing an IBM 8100. It is a modular system in which the user defines the operating environment for each registration period by selecting options from a comprehensive function list. This paper describes how the system functions.

The State University System of Florida has developed an on-line registration system in a distributed processing environment utilizing an IBM 8100. This paper will elaborate on how the system functions and provide background material on its concepts, development and implementation.

In the State University System there is an office of Management Information System (MIS). One of its responsibilities is to supplement the universities' programming support staff by developing and maintaining common system software which can be used by an institution. This function is performed by the Uniform Systems Group of MIS. The development of the IBM 8100 Registration system was a joint effort by the Uniform Systems Group and the University of Florida system support team for student affairs. This project was the first system developed to operate in a distributed processing environment.

The project was started in December of 1979, and in June of 80, after expending less than one man year of effort, it was successfully implemented at the University of Florida. Since then three more institutions have installed the system. In our judgment, the system met the three primary objectives that we stated it must satisfy. First, the system, both hardware and software, must provide the user with a stable operating environment. Second, we wanted to reduce the development cycle for new systems. And last, it must improve service to the student.

The State University System is composed of nine institutions that operate in a multi-campus environment to provide instruction to a combined enrollment in excess of 120,000 students. Institution enrollments vary from 32,000 to 4,000. The variable sizes and multi-campuses combine to establish different needs for each institution. This is particularly true in the process of registration. Before the 8100 system there were many problems associated with the existing registration systems within the state.

The manner of registration varies with each institution. Some are batch, some are on-line and some are a combination of both. Three institutions purchased vendor supplied packages which over the years have been individually modified to satisfy unique requirements. Although each institution has its own analyst and programming support personnel they have had increasing difficulties maintaining these systems. Those institutions that developed their own registration software have experienced similar problems.

Regardless of how the software originated, all were designed and written 8-10 years ago to run on computer systems long since replaced by newer technologies. The resulting differences among the nine institutions has made it virtually impossible for any one system to be transported and installed at another institution.

The obsolescence of registration systems was not the only factor that was responsible for developing a new registration process. Several years ago the university system consolidated its computer resources and formed a network of five regional data centers. A larger computer complex would offer users more services through increased computing power and extended software resources. Our administrative users have access to three of the regional data centers. This concept has been the gateway for users to expand their use of the computers and has led to the conversion of many systems from the manual process. The regional data centers are a proven success.

The concept has not progressed without problems along the way. We have experienced rapid user growth over the last six years and to many the scenario is probably familiar. Every year each data center has had to have a major component of the computer hardware upgraded to keep pace with customer service requirements. The addition of more disk or memory, or a new CPU is almost routine. Sometimes it has not happened soon enough.

In the last couple of years, we have seen some adversity with the transition to computerized systems, especially for those users who have implemented on-line systems. The occasional instability of the computer has had a traumatic impact on those users whose operations are substantially automatic. The ripple effect from a hardware or software failure can temporarily paralyze the functioning of a campus office. This is particularly disconcerting when it happens during registration. For a batch registration system, the problem is uncomfortable but manageable. For an on-line user, it can be devastating. Although this is the reality of our computerized era, nonetheless the loss of service is disruptive After several institutions experienced long student lines, cancelled registration days and disgruntled faculty and administrators, the need to revitalize the registration process became a priority item. Any on-line system has an obvious risk. Our objective is to minimize the risk by stablizing the environment with more reliable hardware and software.

We view the 8100 registration as a standalone system when performing the functions of registration. In general, the 8100's talk to the host computer at two points; first, at the time data files are sent to the 8100 and second, when the results are sent to the host files. Generally this occurs at the beginning and end of each day. The initial file down-load is done periodcially according to the number of times registration will occur. A single data transfer from host to 8100 could handle registration for the entire term. However, the user has the option of sending updates to the 8100 files on a daily basis should it be necessary. The flow of data back to the host occurs daily or at longer intervals according to user procedures.

All our 8100 sites are operating under the distributed processing control executor (DPCX). The DPCX operating system is designed to function under the central control of a host computer. Original program code can be entered at the 8100 using DPCX host programming language, sent to the host for assembly and eventually returned to the 8100 in executable form. Under DPCX all programs must be assembled at a host. The programs are validated by Program Validation Services (PVS) and transmitted to the 8100 by Distributed System Executive (DSX).

The relationship of the host to the 8100 serves two primary purposes. It allows data to flow in either direction and provides the mechanism to assemble programs at the host for eventual execution at the 8100.

The hardware of the 8100 is configured to user specifications. Of the six systems we have in the state, each has a slightly different configuration. The commonality among them are the 512 K of memory and the 58 MB of external storage. The types of devices vary with each system. Devices are attached to the system by direct attachment, by a loop or through a data link. We are using in various combinations 3276, 3277 and 3278 CRT display terminals, 3287 and 3288 character printers and 3289 line printers.

The minimum requirement for program execution is a 384K IBM 8100 system. A minimum external storage will accommodate DPCX and system application programs. Additional disk storage is a function of user requirements. As a guide, the system requires 256K bytes per 1000 student records and a maximum of 1.2 megabytes fixed for class schedule. All display terminals supported by DPCX can be used to operate the system.

The registration process begins with the preparation of host files for transmission to the 8100. A student file and a class schedule file is formatted with information essential to execute registration. These files at the 8100 can be modified with add or change transactions. This is particularly helpful in accommodating last minute student and course changes as they arise.

At the 8100, the user selects how registration will operate for a given cycle. In our nine university environment, we recognized the need to manage minor unique characteristics for each institution. Each user defines to the system the registration and student edits to be performed, an additional set of special functions to execute, and the devices and modules to access. The assignment of allowable operators on the system and functions they can perform is made through a security system.

The process of registering students is designed to allow for heads down data entry of student and course information. Except for special situations, all information entered during a registration attempt for a student is numeric. A brief message is displayed to the operator indicating the status of the registration attempt. The student is immediately informed of the results and subsequent actions are taken in accordance with institution policy.

The system supports other functions of registration such as closed sections, enrollment statistics, printed schedules and others depending on the system definition selected by the users. The final step in the process is the formatting of transactions for transmission back to the host for master file updating.

The average response time we have experienced from the time the terminal operator hits the enter key is 6-9 seconds. The average keying and response time for an operator per student is 17 seconds. Response times will vary according to the number of courses a student registers for, the number of terminals used in registration and the functions selected for a registration.

REGISTRATION SYSTEM CONFIGURATION

The one aspect of the registration system that provides its greatest flexability is a series of modules that allow for a tailoring of the system at each institution. These functions are limited to a single operator, identified as the registration control operator, for obvious security reasons. At the time the registration system is initially installed, the registration control operator would exercise the various modules and establish a base definition of the system to fit the institution's processing requirements. From this point on the definition need only be changed as dictated by differing requirements. The definition may be changed at any time.

Different definitions may be used for each registration period; i.e. pre-registration, drop/add, etc. At the extreme, a definition may be modified and caused to take effect immediately, even between the processing of two registration transactions by the same operator.

The registration control operator when performing the system configuration and providing a base definition of the way the system is to function is really identifying the operators allowed to use the system and the way they will function and the terminals and printers assigned to the system.

The first step in this process is the assignment of operator ID's and passwords for each operator that will be allowed to operate the system. Currently only twelve different operators may be assigned from a selected range of available ID numbers. Passwords may be unique, assigned by function or common to all operators. It is these ID numbers and passwords assigned that are used to implement system security throughout the remainder of the system.

Once the valid operators are identified to the system the next step would be to define their access privileges to the other system modules. The modules over which control is placed are those which have file update functions, display student information or may have an impact on system resources. These modules are:

Student Record Update & Inquiry - access may be denied, limited to display or full update capability granted.

Class Schedule Update & Inquiry - access may be denied, limited to display or full update capability granted.

Registration-Drop/Add - operators may be denied these functions, limited to either registration or drop/add or allowed to perform both functions.

Student Demographic & Registration Display - operators may be allowed to display this information or denied access to it.

Section Listing - the unrestricted use of this module by those unfamiliar with its operation could impact overall system performance so access to its use may be denied.

One additional item identified for each operation is the assignment of an edit/function definition to be used when the operator is performing the registration or drop/add modules. The content and function of this definition is covered fully in the following paragraphs.

The third step in the system configuration is to establish edit/function definitions. These definitions identify the types of editing to be done and any special functions to be performed by the registration - drop/add modules when they are being executed by authorized operators. Up to three separate definitions may be established. Only one may be assigned to an individual operator at any given time, however.

The edit function/definitions specifically identify which of the following items are to be performed during registration or drop/add.

COURSE EDITS	STUDENT EDITS	FUNCTIONS
Seat Availability	Administrative Holds	Print Schedule
Time Conflicts	Appointment Time	Charge Late Fee
Duplicate Course	Previous Registration	Allow Partial Schedule
Permit Course	Credit Hour Load	Closed Sections
Linked Course	Overload	
Variable Credit		
Grade Option		

During the establishment of the definitions, a unique number is assigned each definition and then a series of YES/NO responses is placed after each item.

The final step in the registration system configuration is the assignment of terminals and printers. This may be somewhat misleading since access to the system is not restricted by terminal. The function here is to identify which printers will be used by an authorized operator, performing registration or drop/add, when their definition indicates that a schedule confirmation is to be printed or a section is to be printed when it closes as the result of a registration.

In setting up this device configuration, a unique number is assigned to each possible configuration. The following prompts are presented and the appropriate addresses supplied.

PRIMARY DEVICE
PRIMARY PRINTER FOR SCHEDULE
PRINT QUE FOR SCHEDULE
CLOSED SECTION PRINTER
CLOSED SECTION QUE

The print queues are temporary holding areas should the printer be out of service at the time.

The definition of what registration functions an operation may access, the types of edits performed on registrations and the destination of any printed output is all controlled through the use of the system configuration modules. By assignment of different definitions, three operators in one or several locations may be performing completely different edit on registration input and any printed output could be routed to a central location or printed locally at the operator's site.

PRIMARY FILE MAINTENANCE

When the Student Record and Class Schedule data to be used for registration has been selected and transmitted to the distributed system, the requirement that they be updated does not end. Registration is a dynamic process. Students must be added to the file or have their information changed. Additional course sections will need to be opened or existing sections will need to be modified to reflect changes in enrollment limits, meeting times, etc. Two separate modules in the system, one for each file, provide for the update functions required to maintain the primary files once they have been sent to the distributed system.

STUDENT RECORD UPDATE/INQUIRY

The Student Record Update & Inquiry module provides access to the student's demographic information used during registration. The type of access allowed for each operator is determined by the operator's definition established during system configuration. The operator may be limited to displaying the student's information, allowed to update it or restricted from accessing the data entirely.

If update capability has been authorized, the basic functions of add, change and delete may be performed. Students not on the original file may be added by entering the minimum data requirements of student identifier, last name and classification. All data on existing students may be changed, including the student identifier. Should the need arise, the student's record may be deleted from the file.

During the registration process, this module could serve in several different capacities. Upon presentation of the proper authorization and/or documentation students could have their basic data changed. Students not on the file who come to registration could be added to the file and allowed to complete registration with a minimum of disruption to the process. Additionally, it could be used as a screening device to check for the presence of academic or administrative holds and registration appointment times prior to the student's entry into the registration area.

CLASS SCHEDULE UPDATE/INQUIRY

The Class Schedule Update & Inquiry module allows access to all information regarding a specific course section. Again, the type of access granted to an operator is determined by their definition established during system configuration. Access to the module may be denied, limited to display or full update capabilities may be allowed.

If updating is allowed, new sections may be added to the file with the minimum information required being reference number, college, prefix, number, credit and enrollment limit. Additional information may be input as required by the registration process. Editing is performed to insure the validity of data entered.

In the registration process, this module may facilitate several different functions. The primary function is that of making modifications to the schedule. New sections can be added or enrollment limits of existing sections can be modified to reflect increased demand. The display of a section can be used as an aid to assist students with particular registration problems when additional data on specific registration requirements is required. It represents the fastest and easiest way faculty and administration can retrieve up-to-date enrollment information about a specific section.

REGISTRATION - DROP/ADD

The registration and Drop/Add modules, as the names suggest, are used to perform the initial student registration, modify this information by adding and dropping course sections and record enrollment status changes such as withdrawals and cancellations.

The student, following the registration procedures of the institution, completes a registration or drop and add form. The minimum information required is a four digit reference number used to identify each course being added or dropped. For courses being added, additional information may be required depending on institutional selection of certain options; credit would be required for courses identified as variable credit, grade option taken for those courses which allow audit or pass/fail grades, instructor's permission for sections having restricted enrollment. College or department approval if the student is registering for credit in excess of some predefined limit.

In addition to the information completed by the student, additional codes may be used to override the edits identified to be performed during the registration process. At some point, the student is going to appear at registration and the data entered into the system.

The input data for registration and drop/add is entered as a continuous string of up to 79 characters. An example is shown with all possible values and these are explained below.

```
123456789A+2101V030GAPYOTEAL-2102L06
SSSSSSSSSB+RRRRVcccGpPYOeEtt-RRRRLhh
```

SSSSSSSSS	Student identifier.
B	A code indicating certain student level edits are to be ignored.
+	Indicates the following courses are to be added.
RRRR	A course reference number.
Vccc	Indicates variables credit and CCC is the credit to be used.
Gp	Indicates a grade option and p is the option selected.
PY	Indicates permission has been received for a permit course.
Oe	Denotes a specific edit for this course is to be overriden, where e indicates the edit.

E++	Enrollment transaction type indicates when a student registered for a course and fee liability. Presence of this code indicates the normal system default is to be overridden and the input code ++ used.
-	The following courses are to be dropped.
Lhhh	Registration load field. The sum of the credit hours of the courses the student is registered in is compared to the total represented by hhh.

It is important to note that not all input is as complicated as this may appear. The exact content of the required data to be input is dependent on registration options selected and course requirements.

Once the input data has been entered by the operator, it is scanned for syntax errors. Any errors are displayed to the operator for correction. The student level edits are performed next, based on the edit definition for the operator. The following edits are performed in sequence: verify that the student is on the file, previous registration, academic or administrative hold and appointment time. The operator is notified of the first error encountered. Depending on registration procedure, the operator may direct the student to a problem area to correct the situation or may use one of the override codes to bypass any error except that instance where the student is not on the file. If no error occurred at the student level, processing of the input courses begins.

In processing the course input, all drops are applied to the student's record in the first pass. The operator is notified of any unmatched drop transaction, but processing continues. The input courses are again scanned this time for any add transactions Adds are processed in the sequence input and the following edits are performed based on the edit definition, section requirements and override codes.

Invalid Reference Number
Seat Availability
Permit Course
Cancelled Section
Variable Credit
Duplicate Registration
Held Section
Grade Option
Time Conflict

The first error found for a course terminates further processing of that course.

After all add transactions have been processed, the students' courses are then scanned to insure that all linked course requirements have been met.

If the student has any errors at this point and partial schedules are not allowed, the operator is notified of all errors found and processing ends.

Next, the registration load is compared to that input. If they are different, processing ends and the operator is notified of that and any other errors. If required, the registration load is checked against a predefined maximum to see if an overload situation is present. If it is, the operator is prompted for a response to continue or terminate processing.

At this point the input data (adds and drops) is scanned and the class schedule is accessed for all transactions successfully processed in the first phase. The enrollment counts are adjusted accordingly based on the transaction type. If a closed section is encountered and partial schedules are not allowed, the course is errored and the effect of previously processed transactions is backed out. If partials are allowed, the course is errored but processing continues.

Should a section close out during the processing, a notification of this is sent to the closed section printer identified for the operator. This information can then be posed in the registration area to inform others of the fact the section has closed.

At the completion of the registration or drop/add process, if the student had no errors or had errors but a partial schedule was permitted, a transaction reflecting the activity that occurred is placed in a log file. A printed confirmation of registration is prepared if one was requested. The operator is notified of the completion of processing for the student.

On any attempt at registration or drop/add regardless of its success, a statistical record is updated with information about the current transaction.

SYSTEM SUPPORT MODULES

In addition to the basic modules which provide update and display capability to the student record and class schedule and the registration and drop/add modules used to record the students' registration information, several other modules are available. These supporting modules can be used in various ways to assist the overall registration process.

MENU

The Registration System Menu is the first display an operator sees following the initial sign to the system through the security module. This screen lists the various modules available to the operator, a description of the function performed by the module and the access code used to invoke the function. Its purpose is to assist the casual user of the system in moving from one module to another. The more experienced user will use the available function keys to effect a transfer from one module to another without returning to the menu.

SECTION STATUS

This module will allow for the display of up to ten course sections. The full course identifier, title, location, enrollment, seats available and status (cancelled, closed, open) of each section is displayed. The courses to be displayed are selected by entering the reference number of the desired sections.

This display can be used by anyone (advisors, faculty, etc.) who need to know the current enrollment in a limited number of sections. One institution has a terminal set aside in the registration area so that students may enter the courses they wish to register for and check the status before waiting in line only to find some of their requested courses are closed.

SECTION LISTINGS

The Section Listing is a class schedule inquiry module. It is far more comprehensive than the Section Status module. It can display or produce printouts of selected courses.

Upon entry into the Section Listing module, the operator is presented a available are:

(a) selection of closed, cancelled, open, held or all sections;
(b) selection by college, department, prefix and/or course number;
(c) selection by reference number range; and
(d) selection by campus.

These options may be used in any combination to achieve the desired selection of courses.

The Section Listing output will show the full course identifier, title, credit, meeting times and location and enrollment date. The display or printout may be used in a number of different ways. Using the display option and selection criteria of open sections and some combination of college, department, prefix and number selection, students may be assisted in course selection for registration or during drop/add when many sections are closed. College administrators may use the display to monitor enrollment data in selected sections. One important use of the module would be to produce hand copy reports of closed sections on a regular basis and make these available to advisors or to students in the registration area.

REGISTRATION RECORD DISPLAY

The Registration Record Display will display the student's basic demographic data and all course information. The course data includes the full course identifier, title, credit grade option and meeting times. Dropped courses are retained and displayed with the notation "course dropped" and the date it was dropped. This way a full record of the student's activity can be displayed.

This display could be used by many offices on campus that require access to this information. Advisors could use it as a counseling aid during the drop/add. The cashier could use it to verify the student's current credit load and registration status. Certainly other offices could benefit from having this information available.

REGISTRATION STATISTICS

Each time a student attempts to register or drop and add a course, a record of this activity is posted to a statistical record. The data recorded is number of attempted and successful registrations, the number of drop/add attempts and courses dropped or added and current enrollment counts as to number of students and total credit. Also recorded are the number of errors by type encountered in processing these transactions.

The data recorded may be displayed at any time during the registration process. Everyone is interested in the progress of registration. "How many students have registered" is the often heard question. This display will provide the answer.

THE MBRCC STUDENT RECORDS SYSTEM WORKS!

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1980 CAUSE National Conference

December 7-10, 1980

Phoenix, Arizona

THE MBRCC STUDENT RECORDS SYSTEM WORKS!

I. INTRODUCTION

Developed for the Software Cooperative established by the Massachussetss Board of Regional Community Colleges by Arthur D. Little Systems, Inc., the system is now installed in two Massachusetts community colleges and a private, liberal arts college, Rockford College in Rockford, Illinois (McFadden and Rodgers, 1980). The idea of a "software cooperative" was originally recommeded by a task force at North Shore Community College (Beverly, Massachusetts), appointed by the President to determine the computing needs and strategic alternative of the college. Five strategic options were identified (Clements and Rodgers, 1977). The North Shore staff recognized that the college could not afford to develop the software required to meet the needs identified. The Task Force recommended the formation of a "software cooperative." The concept has been accepted by about half of the other fifteen members of the Massachusetts Community College system. Technical support is provided by Arthur D. Little Systems, Inc., and the Data General Corporation is the common hardware vendor.

The sections below review the history and development of the Software Cooperative, the functional design and the architectural environment of the Student Records System, and the conclusions and the implications for data processing in American higher education which may be drawn from the Massachusetts Board of Regional Community Colleges (MBRCC) Software Cooperative.

II. HISTORY AND DEVELOPMENT

A. FORMATION OF MBRCC SOFTWARE COOPERATIVE

MBRCC has made every effort to develop and implement an efficient and cost-effective computer capacity for all fifteen member colleges. The objective is to provide each college with sufficient computing support to effectively and efficiently meet the identified academic and administrative computing needs of each of the fifteen colleges and the MBRCC. The history and development of the long-range plan and the Software Cooperative are explained by Asquino (1972), Farmer (1976), Clements and Rodgers (1977), Tagney (1978), Rodgers and Traicoff (1978 and 1979), Gauthier and Rodgers (1980), and McFadden and Rodgers (1980).

The Massachusetts community college's plan is based upon minicomputers. It was visionary for its time--since minicomputers are just now supporting the types of operating systems, program languages, file handling and accessing capabilities, and communications protocols (Data General, 1980) necessary to implement the plan as described in Toward A Plan of Action (Asquino, 1972). Since 1974 the Massachusetts community colleges have issued three Requests for Proposals to minicomputer equipment manufacturers. Bids resulting from the first two RFPs were not accepted pending further study. The third RFP, issued in 1977 and based on a study by Farmer (1976), resulted in the award of a MBRCC system-wide contract for minicomputers to the Data General Corporation of Westboro, Massachusetts for the ECLIPSE series equipment. The MBRCC Software Cooperative was established on March 30, 1978, by vote of the MBRCC Presidents Council.

B. IMPLEMENTATION OF THE MBRCC SOFTWARE COOPERATIVE

A comprehensive plan was developed for the implementation of the MBRCC Software Cooperattive. This plan is based upon the commitment to ensure adequate involvement of the intended users of the MBRCC Student Records System in the priority establishment, design, and implementation processes based upon the following four major phases;

- Phase I: Prepare Strategic Information System Plan;
- Phase II: Develop System Design;
- Phase III: Develop and Test Application; and
- Phase IV: Install Application at Each Member College.

Phases I and II, and Phase III are now completed. Warranty and acceptance testing under a Phase IV Installation Agreement is also completed. This section reviews the progress to date in implementing Phase IV of the MBRCC Software Cooperative. The activities of Phases I, II, and III were reported by Rodgers and Traicoff (1978 and 1979), Gauthier and Rodgers (1980), Bear (1979), and Arthur D. Little Systems and Opinion Research Corporation (1978), and Arthur D. Little Systems (1979 A and B).

C. PHASE IV--INSTALLATION OF APPLICATION SOFTWARE AT USER's SITE

During this phase, the application software will first be installed at Berkshire Community College in Pittsfield, Massachusetts. Acceptance and warranty testing was conducted between April and October, 1980. During this procedure, the Berkshire Community College performed the acceptance testing and warranty testing on behalf of the Massachusetts community colleges. Best professional efforts were exerted by Berkshire and ADLS staff during the testing period so that the full capabilities of the system would be tested similar to the environment in which the system will actually be used. A total of thirty-eight errors were discovered and corrected during the testing period at Berkshire. After completion of the testing, the system is now available for installation at other colleges. North Shore Community College began installation in June, 1980, and is now putting the system in production.

The ADLS installation service for installing the system is based upon an organizational development approach which includes the services to minimize the disruptive nature of installing a system of this scale at a college. The activities are identified in Figure 1 which include the following:

Stage of Implementation	Objectives	Implementation Tasks for SRS
Assessment	Initial evaluations of needs vs. expertise	Negotiate Installation Agreement
Entry	Development of collaborative working relationship Establishment of commitment levels Responsibilities delegated Priority setting Agreements established	Refine Educational Computing Priorities
Diagnosis	Data gathering Joint definition of organizational needs and likely responses	Review of Functional Specifications Conduct System Configuration Analysis
Planning	Formal goal setting Timetables set Alternative plans evaluated Choice made Evaluation criteria determined for later use	Advise on Procurement/Modification of Equipment Design Communications Network Determine Administrative Procedural changes Develop Database Generation/conversion plan Redesign Forms as required Design Security System Procure Data from External Sources Develop New Codes Develop Acceptance Testing and Training Plans Train Users of System Prepare User and Technical documentation Develop and Review Implementation Plan
Action	Implementation stage Education/Training Feedback on results Communication between and among responsible parties	Install Software Applications on college computer ADLS runs diagnostic tests Convert/generate databases Conduct acceptance testing of each module: – Admissions – Financial Aid – Registration – Registrar's Processing Make adjustments according to acceptance plan
Evaluation	Assessment of action in terms of evaluation criteria Diagnosis	Accept SRS Complete installation of new system End parallel operations of old system
Post–Installation	Maintenance of Software Institutional Mechanisms	Post–installation agreements Evaluate Implement Process

FIGURE 1 SCHEDULE OF IMPLEMENTATION SUPPORT IN MBRCC SOFTWARE COOPERATIVE

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- Assessment
- Entry
- Diagnosis
- Planning
- Action
- Evaluation
- Post-installation

During the action stage, the acceptance testing is completed. At this time, the college is eligible to initiate a software subscription service for maintenance of the software or the college may elect to maintain the software on its own. This conversion schedule has been developed from the experience at North Shore in the use of the pilot registration system (Rodgers and Traicoff, 1979), and the installation at Berkshire and North Shore Community Colleges in 1980, and the consulting and research experience of ADLS staff (Rodgers, 1980).

III. FUNCTIONAL REQUIREMENTS AND ARCHITECTURAL ENVIRONMENT

A. FUNCTIONAL REQUIREMENTS

The Student Records System is a management tool for the planning, management, and evaluation of the academic program of each institution, individually, and the Massachusetts community college system as a whole. The Student Records System consists of a database and tools for building, maintaining, and reporting from the database. The design of the Student Records System and the software techniques and technologies employed are consistent with the expressed policy direction of preserving the institutional autonomy of each college which uses the system - recognition of the diversity of their educational and administrative philosophies - external reporting to MBRCC and other state and federal agencies. The various functions supported, including academic computing, are described below.

- Database

The database for the Student Records System includes the following areas:

- student records, including admissions, testing and counseling, registration, transcript, and degree audit information;
- curriculum - all approved courses and other learning experience, such as classes, laboratories, seminars, tutorials, as well as off-campus activities;

- facilities information related to assigning classroom space;
- faculty information related to appointments, and instructional time and effort; and
- financial information related to financial aid and student payroll authorization.

- On-Line, Real-Time, and Batch Access to the Database

On-line access permits the users to perform data entry, maintenance and inquiry functions by accessing appropriate data in the database. Batch access is also required. Real-time and batch processing modes are to be balanced in order to avoid a negative impact on system performance.

- Functional Applications

Figure 2 presents an overview of the functional design of the Student Records System.

- Flexible Report Generating Capability

The system software of the Student Records System includes a report-generating capacity to produce unique, one-time reports from the database.

- Transaction-Based System

All modules of the Student Records System are based on integrated, transaction processing. A transaction is a series of pre-determined tasks which are initiated upon the entry of specified data. These transactions are processed by the application software.

- Distributive System Environment

Distributive systems embrace a network of data processing and communication capabilities which localize the generation and maintenance of data throughout the organization at points where the organizational units have the authority and responsibility for the generation and maintenance of relevant data. The Student Records System is capable of operating in a distributive system environment.

- Word Processing

The system software of the Student Records System supports a word processing capability to produce repetitive and variable insert letters using data stored in the database with direct output to a typewriter-quality output device. The memory capacity and sort capabilities of the database are available to support word processing.

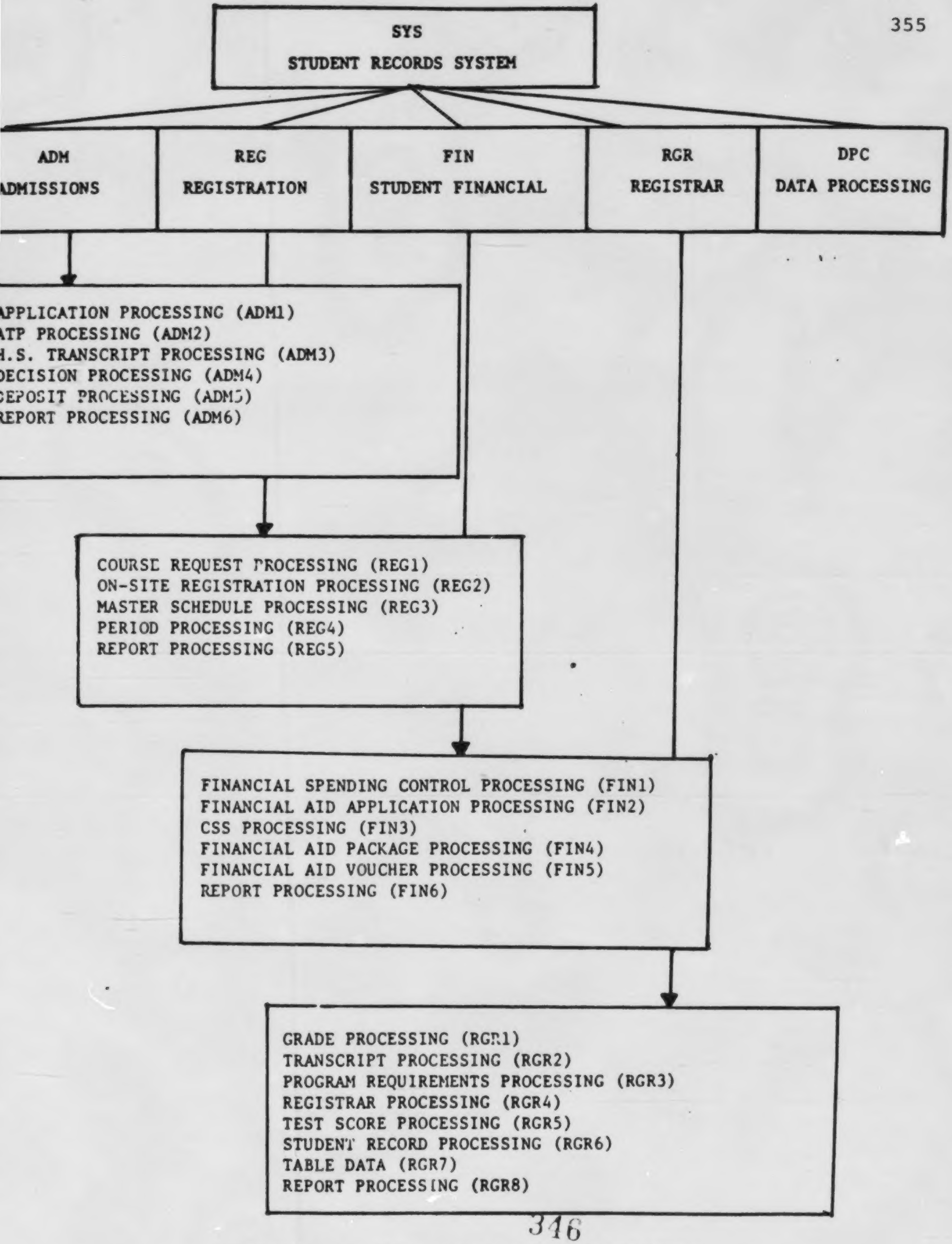
SYS
STUDENT RECORDS SYSTEM
ADM
ADMISSIONS
REG
REGISTRATION
FIN
STUDENT FINANCIAL
RGR
REGISTRAR
DPC
DATA PROCESSING
APPLICATION PROCESSING (ADM1)
ATP PROCESSING (ADM2)
H.S. TRANSCRIPT PROCESSING (ADM3)
DECISION PROCESSING (ADM4)
DEPOSIT PROCESSING (ADM5)
REPORT PROCESSING (ADM6)
COURSE REQUEST PROCESSING (REG1)
ON-SITE REGISTRATION PROCESSING (REG2)
MASTER SCHEDULE PROCESSING (REG3)
PERIOD PROCESSING (REG4)
REPORT PROCESSING (REG5)
FINANCIAL SPENDING CONTROL PROCESSING (FIN1)
FINANCIAL AID APPLICATION PROCESSING (FIN2)
CSS PROCESSING (FIN3)
FINANCIAL AID PACKAGE PROCESSING (FIN4)
FINANCIAL AID VOUCHER PROCESSING (FIN5)
REPORT PROCESSING (FIN6)
GRADE PROCESSING (RGR1)
TRANSCRIPT PROCESSING (RGR2)
PROGRAM REQUIREMENTS PROCESSING (RGR3)
REGISTRAR PROCESSING (RGR4)
TEST SCORE PROCESSING (RGR5)
STUDENT RECORD PROCESSING (RGR6)
TABLE DATA (RGR7)
REPORT PROCESSING (RGR8)

FIGURE 2 -- FUNCTIONAL SPECIFICATIONS

- Combined Academic and Administrative Processing

The Massachusetts community colleges have elected a strategy of combined academic and administrative processing on the same equipment. This strategy may be achieved within a reasonable performance expectation of the system (Bleiweiss and Gardner, 1980).

B. ARCHITECTURAL ENVIRONMENT

The architectural environment of the Student Records System is based upon the Data General ECLIPSE equipment (Data General, 1980). The environment may be summarized as below:

- The Data General ECLIPSE series equipment--the 16-bit machines (the C/150, C/330, C/350, and the M/600) as well as the new 32-bit product line, the MV/8000, may be utilized to support the Student Records System. Appropriate configuration is prepared based upon production and workload requirements of each college or university. Permit a brief summary of the base configuration developed by the Massachusetts community colleges. Note that the base configuration includes a half a megabyte CPU, two 96 megabyte disk drives, one dual density tape drive, and approximately 16 terminals. This base configuration was developed in 1978. In order to support current system software and academic computing, it is recommended that a 1.0-megabyte CPU be selected as opposed to .5-megabyte. However, the specific configuration requirements for an individual institution must be selected based upon their own workload requirements. The performance of the specific configurations are measured utilizing the performance model identified above (Bleiweiss and Gardner, 1980).[1]

- Operating System--the Student Records System operates under the Advanced Operating System (AOS), a multi-task, multi-processing operating system which supports time sharing, on-line, and batch processing. Many small colleges and universities will be utilizing the ECLIPSE equipment for both academic and administrative processing. Therefore, AOS was a main candidate for an operating system as opposed to the Real-time Disk Operating System (RDOS). The new operating system for the MV/8000, AOS/VS, has been announced. It will support the application software which has been developed under a 16-bit architecture machine and running under AOS (Data General, 1980).

- Program Language--the program language selected for a Student Records System is AOS COBOL, with the terminal management facilities of AOS COBOL. The language was selected because of its wide use and preference in administrative applications for colleges and universities. We have isolated the file handling components of the COBOL programs into file handlers so that upgrading of the file handling from INFOS to a database management system may be facilitated.

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1) Note that the current recommended minimum equipment configuration for AOS and INFOS is 786 kilobytes.

- File Handling and Access Capabilities--the file handling tool which has been selected is INFOS, with INFOS QUERY. As mentioned above, the file handling components of application programs have been isolated so that upgrade to a database management system may be facilitated. In the future, we intend to upgrade the file handling capability to a database management system.

- Word Processing--the system architecture is designed to include a word processing capability which will utilize the sorting and record keeping capabilities of the Data General ECLIPSE computer with typewriter quality output. Colleges have a strong demand for repetitive letters, variable insert letters, and text preparation capabilities of word processing software. The AZ-TEXT software available from Data General and other products available from Data General OEM's are currently being analyzed for meeting the functional and technical requirements for word processing. To date, no member of the Software Cooperative has installed a word processing capability.

- Communications--in the future, it is expected that communications will be of more importance to the members of the Software Cooperative. The Data General software supports a full line of communications including remote job entry, as well as networking interfaces. As of this time, no college has used a communications capability (other than with modems) with the Student Records System. However, we have planned the architecture with the intention of colleges being able to use both RJE and network communication approaches.

- High Level Reporting Language--in order to meet the needs for ad hoc reports and query capabilities, a report generator and high level reporting language will be required. Currently, QUERY and REPORT WRITER are two available tools with INFOS to meet this requirement. In the future, utilizing the capabilities of a database management system, we expect to have enhanced capabilities for both query and ad hoc reporting. These features are one of the reasons why we are interested in upgrading the file handling capability to a DBMS.

IV. IMPLICATIONS FOR DATA PROCESSING IN AMERICAN HIGHER EDUCATION

The activities of the MBRCC Software Cooperative have been an important chapter in the history of data processing in American higher education. Among other things, the MBRCC Software Cooperative has demonstrated the practical utility and efficacy of sharing the development, implementation and maintenance of a complex, on-line system with several colleges. This project has made another strategic option available for colleges to consider in acquiring application software to meet the requirements, both strategically and operationally, for the 1980's. To some extent, the completion of the Software Cooperative efforts is similar to William Faulkner's short story, The Bear. If you are familiar with this story, you will recall the common bond of excitement and challenge which held together the diverse interest of the hunting party over its many years of searching for the cagey, crafty, and illusive bear. After the bear was caught, the party dispersed into their separate ways. Before the leadership of the Software Cooperative makes such dispersion, we would like to share with you the benefit of our experience so that others may not have to repeat the many mistakes which we made. Rest assured, you will make mistakes, but perhaps your mistakes can be new mistakes.

The Software Cooperative has been a unique undertaking for a group of colleges and a commercial organization. Below we summarize the perspectives and thoughts relative to the important conclusions resulting from this project both from the point of view of the participating colleges as well as the commercial service organization.

A. PERSPECTIVE OF THE PARTICIPATING COLLEGES

Based upon the experience of the leadership of the MBRCC Software Cooperative, the following advice will be made to other institutions which wish to consider installing cooperatively developed software applications:

- The President and his or her chief management team must be committed to the project, ready to support this effort, and prepared to lead the college into a major change which will undoubtedly be disruptive to the normal operating style of the institution;

- A trusted and respected employee of the college should be designated as Project Director, responsible for working closely with the software development team, the hardware manufacturer, and other institutions using the system. The Project Director must have the authority to develop and carry out an implementation plan and report progress to the President and/or his designee;

- An implementation plan, written clearly and concisely, must be agreed upon and assigned by all of the parties involved. This plan should include at least the following:

- a comprehensive listing of the major steps, tasks, and procedures of the installation and a clear assignment of responsibility for each;
- a carefully developed and detailed plan for conversion from the current system of the college to the new system;
- a complete plan for user office staff training specifying the type of training, the hours and the trainer to be involved;
- the designation of the software developer's staff who will be assigned to assist the college in designating a thorough test plan and be responsible to document or answer all problems that arise in the implementation of the testing processes;
- a procedure for reporting problems discovered to the software development team and acknowledgement or resolution of those problems;
- a warranty, or other assurance, of the software product and the conditions related to it;
- a clear statement of what is not included in the installation; and
- the cost of the installation;

- The members of the computer staff should be thoroughly trained and guided through each process of the system by a staff member of the software development team including:
    - how to install updates and revisions;
    - how to request batch jobs and reports;
    - how to back up the system and insure the necessary integrity of files for restart/recovery purposes;

- An early review and resolution of operational software on the host computer must be performed by the applications software development team to ensure that the college's system software is maintained at the required revision and/or releases to accomodate the new system;

- The President needs to be prepared to:
    - personally advocate, support, and define the project to a wide variety of populations, under a wide array of circumstances, and for a seemingly endless period of time;
    - deal with the rising expectations of faculty, administrators, staff, and students;
    - commit future resources to maintaining, modifying, and expanding the system to meet future requirements.

The above recommendations are based upon the experience of Berkshire Community College and North Shore Community College in implementing the MBRCC Student Records System.

B. PERSPECTIVE ON BEHALF OF THE COMMERCIAL SERVICE FIRM

From the perspective of Arthur D. Little Systems, this project has been both challenging and difficult. Its challenges have been in the areas of both the human dynamics and organizational issues involved in orchestrating and coordinating, mostly through leadership and persuasion as opposed to direct influence and responsibility, and the technological capabilities, as well as deficiencies and limitations, of currently available commercial minicomputer technologies. The multi-client dimension of the MBRCC Software Cooperative added a third significant and important aspect. These aspects lead to the four important conclusions for this project from our perspective:

- A service versus a product strategy;
- Governance and management procedure for identifying and resolving conflict;
- A long-time commitment to a common system architecture; and
- Decentralization of technical capacity.

Each of the four issues are discussed below:

The four year project plan described above was based upon a service strategy, as opposed to a product-based strategy, for developing, implementing and testing the Student Records System. The service strategy approach contributes more effectively to achieving broader goals of improving the governance and management of educational institutions through developing, implementing, and maintaining better administrative systems.
we believe that the achievement of these broader objectives will result in the following benefits to the participating members of the Software Cooperative:

- An improvement of the data available for day-to-day administration, institutional policy in decision making, and external reporting and accountability;
- An improvement in the staff and administrative productivity of the colleges; and
- An improvement to the services provided to students.

Fundamental to the service approach is the linkage process which assists the members of the Software Cooperative in implementing their objectives and achieving these desired benefits. This approach is distinctive from other approaches, notably those based upon providing a finished product with little to no opportunity for the client to understand the product before its delivery. A major limitation of the product-based approach is its assumption of a quite inactive role on behalf of the client until such time as the finished product is delivered. Such an approach often leads to unnecessary dependency on the service firm by the client.

We believe that the service strategy utilized in our support to the MBRCC Software Cooperative results in correcting the following deficiencies of the product-based strategy:

- Lack of an explicit recognition of the organizational and interpersonal change involved in developing and implementing complex administrative applications and the likely consequences of such projects (including both desired and undesired consequences);

- The lack of a process that will simultaneously support the production and delivery of the system with respect to:
  - the service required so that the client (both user staff and technical staff) may understand and be able to use the products without undue dependency upon the external organization providing the products;
  - acceptance of the joint responsibility on behalf of the service firm and the client staff to achieve the objective of the project and reduce the risk and liabilities of both parties;
  - and an opportunity to share the knowledge and experience of the service firm's staff and the client's staff with respect to the multi-disciplinary requirements of a complex project of this nature;

- Documentation and evaluation are the benefits to be realized in converting to an on-line, databased oriented administrative system; and

- A management process, presented in the four phased project plan, which explicitly offers an opportunity for significant client participation to effectively manage the organizational change induced by converting to complex new administrative systems.

By correcting the above deficiencies of the product-based strategy, the overall cost (both human and financial) and the risk to the client system is reduced in achieving their objectives for the significant conversion involved. The same strategy leads to developing a final tangible product with the added assurance of the client's understanding of its functionality and technical aspects. For an extended discussion of the above distinction, see Rodgers and Rhodes (1978), and Rodgers (1978 and 1980).

The governance and management of a software cooperative effort is most important. One should begin with the idea that conflict is inherent in such an effort, and that the management of conflict resolution is as important as resolving the technical issues. There are many individuals who will be involved, each with their own aspirations, concerns, expectations, anxieties, and frustrations, as well as hopes and aspirations. Management of the conflict resolution process is a key executive management responsibility. We believe that there are several components of the conflict resolution process which should be considered, including:

- Leadership to support the resulution of conflict;

- Establish set of ground rules for making decisions and resolving conflict through an established or temporary organizational structure; and

- A decision network in which those individuals who will be affected by the new system have confidence that they can influence.

Resolution of conflict has been one of the major activities of the MBRCC Software Cooperative. Many issues have come up over the last four years. No issue has been identified which could not be resolved by reasonable parties coming to an understanding, and one which often required compromise on all parties involved. Many of the concepts utilized as basis for the MBRCC Software Cooperative design were taken from the work of Demb (1975), and Likert and Likert (1976) and Rodgers (1980).

To achieve the economies of scale available through sharing software development requires a long-term commitment to a common system architecture. This commitment for the Massachusetts community college Software Cooperative was achieved through a common bid for a hardware vendor to support all of the Massachusetts community colleges. Once a hardware vendor was selected, the appropriate architecture, matching the functional requirements with the technical capabilities, was elected by Arthur D. Little Systems in consultation with members of the Software Cooperative. In retrospect, ADLS would recommend that future institutions would carefully plan the system architecture prior to preparation for any hardware bid specifications. By committing to a long-term, system architecture, the participating institutions are preserving and protecting their investment in application software. Sharing a common software architecture is also essential to any ability to share the administrative applications between and among various colleges. While the ideal system engineering developments have been discussed for some time which would make application software transportable across various vendors, it is still quite difficult to achieve any practical and reasonable balance between functionality and performance of administrative applications across more than one system architecture. Until there are significant advances in system architecture, we do not believe that it would be practically feasible, to consider attempting to implement a Software Cooperative approach. without committing to a common system architecture.

The technical capability to support the cooperative effort should be decentralized to the member campuses, and not centralized in a central office or system office. It is important that the individual colleges have control and direction to the technical staff, and that the staff are directly accountable to the executive management of the colleges. Decentralization of the technical staff is one of the key reasons for the success of the MBRCC software cooperative, and merits consideration by other multi-campus systems considering development of common'application software for their respective member institutions. Withington has made a similar suggestion in his recent article concerning decentralization of technical talent for divisionalized organziations (Withington, 1980).

V. BIBLIOGRAPHY

Arthur D. Little Systems. Functional Specifications of the Student Records System. Burlington, Massachusetts: Author. 1980.

Arthur D. Little Systems. Architectural Environment of the Student Records System. Burlington, Massachusetts: Author. 1979.

Arthur D. Little Systems and Opinion Research Corporation. Educational Computing Needs and Priorities for the Massachusetts Board of Regional Community Colleges. Burlington, Massachusetts: Author. 1978.

Asquino, Daniel. Towards a Plan of Action. Boston, Massachusetts: Board of Regional Community Colleges, 1971.

Baer, Richard. Conversion of Management Information System for Rockford College. Rockford, Illinois: Rockford College. 1980

Bleiweiss, Lawrence, and George O. Gardner, III. Student Records System Performance Predictions at Berkshire Community College. Burlington, Massachusetts: Arthur D. Little Systems, Inc. 1980.

Clements, William and Kenneth W. Rodgers. Procedural and Data Processing Support Alternatives for Administrative Offices at Spelman College. Cambridge, Massachusetts: Arthur D. Little, Inc. 1977.

Data General Corporation. Data General's Software for Commercial Applications. (DG Reference: #069-000030). Westboro, Massachusetts: Author. 1980.

Demb, Ada B. The Organizational Impacts of Computer-Based Information Systems: An Organizational Development Approach and Case Study of Centralized Systems in Higher Education. Unpublished doctoral dissertation, Cambridge, Massachusetts: Harvard Graduate School of Education, 1975.

Farmer, James. Computers for the Massachusetts Community College: A Review. Washington, D.C.: Systems Research Group, Inc., 1976.

Gauthier, Michael, and Kenneth W. Rodgers. "Software Cooperative for Sharing the Development of a Comprehensive Student Records System," in College and University Machine Records Conference. 25th Annual College and University Machine Records Conference. Salt Lake City, Utah: Brigham Young University. 1980.

Likert, Rensis and Jane Gibson Likert. New Ways of Managing Conflict. New York, N.Y.: McGraw-Hill. 1976.

McFadden, Thomas and Kenneth W. Rodgers. "The Student Records System: Its Functions and Architecture." 7th Annual Data General Users Group National Conference. Chicago, Illnois. 1980.

Rodgers, Kenneth W. and Isabelle N. Rhodes. A Study of the Impacts of Selected Products Developed by the National Center for Higher Education Management Systems. Cambridge, Massachusetts: Arthur D. Little, Inc. 1978.

__________. OEM Software Houses--Marketing Services or Products? Unpublished paper. Burlington, Massachusetts: Arthur D. Little Systems. 1978.

__________. A Modification of the Classical Research, Development, Dissemination, and Evaluation Model for Improving Educational Practice Through the Application of Technology. Cambridge, Massachusetts: Harvard University. 1980.

__________ and George Traicoff. "Computer Cooperative for a Multi-Campus System." in Schouest, Michael E. and Charles R. Thomas, editors, Development Use and Management of Information Systems in Higher Education. Boulder, Colorado: CAUSE. 1978.

__________ and George Traicoff. "Software Development Sharing is Becoming a Reality." A paper presented at the 1979 CAUSE National Conference. November 27-30, 1979. Orlando, Florida.

Tagney, Ronald. Manual of Procedures Related to the Student Record at North Shore Community College. Beverly, Massachusetts: North Shore Community College. 1978.

Withington, Frederic G. "Coping With Computer Proliferation," Harvard Business Review. May-June, 1980. PP 152-164.

Distributed Continuous Registration

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This paper describes the development, implementation and features of the continuous registration system at the University of Northern Colorado.

The system is an on-line distributed processing system. It is written in COBOL for Series I under the CPS operating system.

The registration and drop/add process accommodates multiple terms concurrently and is staffed by lay persons. Walk up students are accommodated. Course data is dynamically adjusted as students adjust their schedules. Course data can be modified or new offerings entered as need arises.

The registration transactions are communicated to the host for processing and the host refreshes the distributed files "nightly".

The University of Northern Colorado utilizes a continuous registration system similar in concept to the system at the University of New Mexico. The system replaced a bullpen/class card registration involving 150 faculty and staff and 65 temporary personnel for twelve days each year.

The objectives of the system are:

- -to reduce faculty and staff time.
- -commitment to registration function.
- -to provide a "less pressurized" environment in which students can select their courses.

The system was implemented on an IBM Series I with 192K of memory, two printers, a 29 meg disk and seven terminals. The software is CPS COBOL. The system communicates to an IBM S370/148 using standard IBM protocol. The total cost of the system is $60,000 for hardware and about $20,000 for the software. The operating maintenance cost is approximately $7,200 per year. The time span from inception of the concept to implementation of the system was fifteen months. This included gaining administrative, faculty, and coordinating concurrence with the concept; modifying host software and procedures; bidding the equipment; writing the software; and training the registrar's staff. We started in June, 1978, and registered students on October 29, 1980. The Registration Center is located in the University Center, a central focal point at UNC. The University Center provides a pleasant environment and convenient access to the registration facilities for students.

The Registration Center is available to process student registrations for the appropriate quarters from 9:00 a.m. to 4:00 p.m. five days a week. It is possible to process as many as three quarters concurrently. To register for a given quarter an opportunity is provided for all students to register during a five week period. Student priority is based on the number of hours completed, starting with graduate students. By scheduling approximately 500 students each day we retain the relaxed casual environment.

The system functions as follows:

> Students are mailed a course selection form (Appendix A.1) at least two weeks prior to their scheduled time to select courses for the appropriate quarter. Students, with the assistance of advisors, are encouraged to select a schedule prior to going to the Registration Center. Once a schedule has been selected, the student enters the four digit course identification number on the reverse side of the course selection form (Appendix A.2). Upon entering the Registration Center students are encouraged to check the course status board to determine whether or not the desired sections are available. The availability of course sections changes dynamically due to registration activity. A student proceeds to the first available terminal and presents the course selection form to the operator. The operator enters the student's ID number and presses a "function key" for the desired quarter. A screen returns with the student's name and headings for entering course identification numbers. If the student is not eligible to register (i.e. a hold or not admitted to UNC) the student is routed to a problem terminal to resolve the situation. The operator enters the course numbers and presses the "add function key". Problems and errors are displayed on the screen. These include closed classes, restricted

classes, student level/course level mis-matches, and overloads. Provisions to authorize the operator to override "problems" is contained in the permit to enroll (Appendix A.3). When all the restrictions have been satisfied, the student's schedule is displayed on the screen. The operator then instructs the system to produce the confirmation for the student on the printer (Appendix A.4). This confirmation is a two part form. The second copy is kept at the Registration Center as part of a recovery procedure. The reverse side of the confirmation (Appendix A.5) is a drop-add form. Students are permitted to adjust their schedules until the end of the drop-add period and use the form to do so. Each time they change their schedule they receive a new confirmation.

Additional features included in the system are:

-The ability to add a student to the system if the student is not on file.

-The capability to increase/decrease a class section size.

-The capability to add an additional section.

-The capability to remove restrictions from a section.

-Production of closed class lists.

-Modification of student information (i.e. remove holds, change classification).

-Data entry for address changes.

At the conclusion of the day's activity the operator exits the registration function and transmits the transaction activity to the S370/148. This process copys the transactions to a diskette for recovery and sets the Series I up to receive refreshed data and diagnostic reports from the host over the night. This occurs in an unattended mode on the Series I.

The Registration Center is staffed and operated by three FTE and seven part-time persons from the Registrar's staff. No technical personnel are required. The staff results from redefinition and assignment with the registrar's existing resources.

The benefits include:

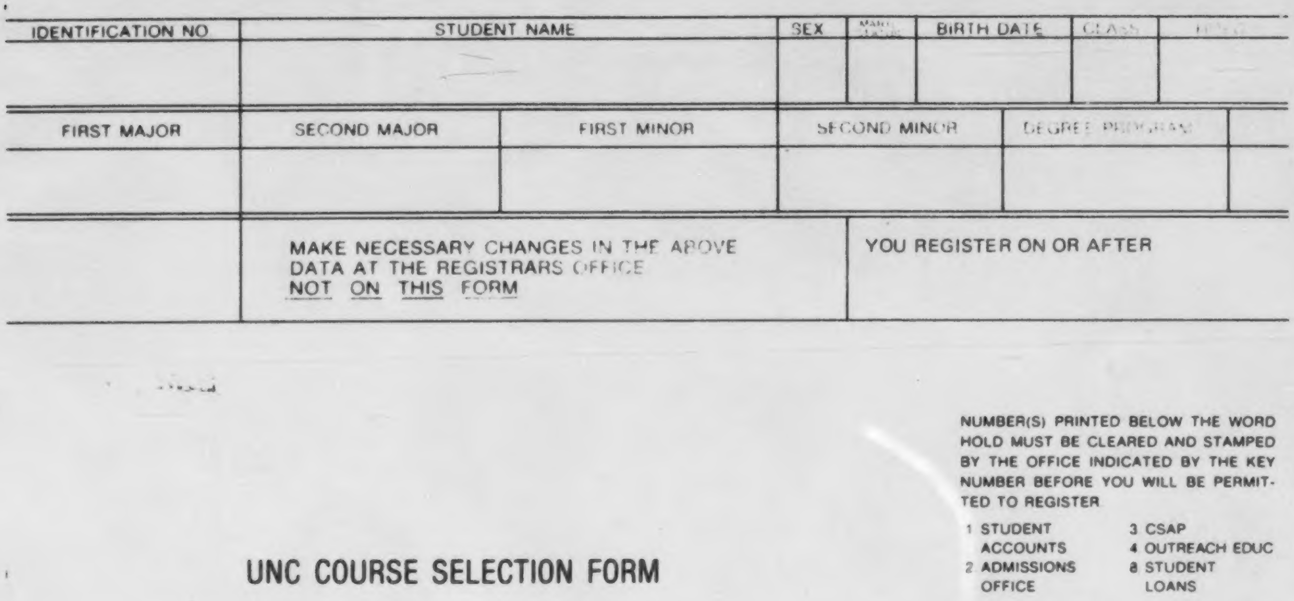
- Personnel cost savings of $7,000 in registrar's staffing.
- Supplies and personnel time in the computer center of $6,000-$10,000.
- Continuous process - no peaks and valleys.
- Technical staff is out of it - system is operated by lay persons.
- Multiple quarters are handled at one time.
- Data changes are used to fill in slack times.
- Student has just one place to go to register/drop/add/withdraw.
- Students like it.
- Faculty like it.

Concerns with the system are:

- Departments must be cognizant of registration over an extended time span.
- Departments no longer have their lists.
- Diminishing return on additional terminals.

APPENDIX A

.1



IDENTIFICATION NO	STUDENT NAME	SEX	MARIT. STATUS	BIRTH DATE	CLASS	HOLD
FIRST MAJOR	SECOND MAJOR	FIRST MINOR	SECOND MINOR	DEGREE PROGRAM		

MAKE NECESSARY CHANGES IN THE ABOVE DATA AT THE REGISTRARS OFFICE NOT ON THIS FORM

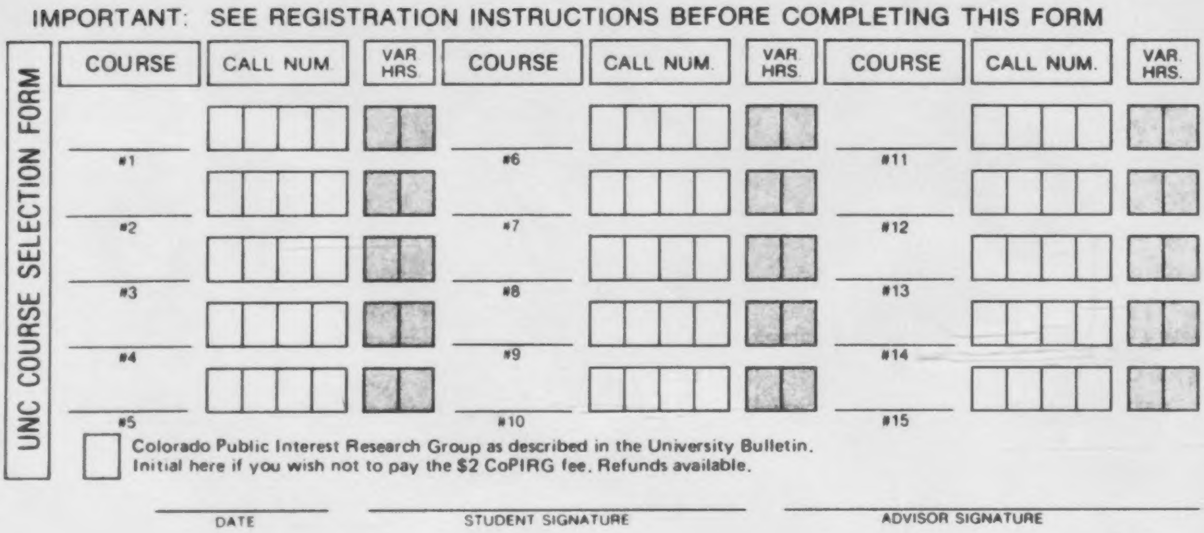
YOU REGISTER ON OR AFTER

NUMBER(S) PRINTED BELOW THE WORD HOLD MUST BE CLEARED AND STAMPED BY THE OFFICE INDICATED BY THE KEY NUMBER BEFORE YOU WILL BE PERMITTED TO REGISTER

1 STUDENT ACCOUNTS
2 ADMISSIONS OFFICE
3 CSAP
4 OUTREACH EDUC
8 STUDENT LOANS

UNC COURSE SELECTION FORM

.2



IMPORTANT: SEE REGISTRATION INSTRUCTIONS BEFORE COMPLETING THIS FORM

UNC COURSE SELECTION FORM

COURSE	CALL NUM.	VAR HRS.	COURSE	CALL NUM.	VAR HRS.	COURSE	CALL NUM.	VAR HRS.
#1	☐☐☐☐	☐☐	#6	☐☐☐☐	☐☐	#11	☐☐☐☐	☐☐
#2	☐☐☐☐	☐☐	#7	☐☐☐☐	☐☐	#12	☐☐☐☐	☐☐
#3	☐☐☐☐	☐☐	#8	☐☐☐☐	☐☐	#13	☐☐☐☐	☐☐
#4	☐☐☐☐	☐☐	#9	☐☐☐☐	☐☐	#14	☐☐☐☐	☐☐
#5	☐☐☐☐	☐☐	#10	☐☐☐☐	☐☐	#15	☐☐☐☐	☐☐

☐ Colorado Public Interest Research Group as described in the University Bulletin. Initial here if you wish not to pay the $2 CoPIRG fee. Refunds available.

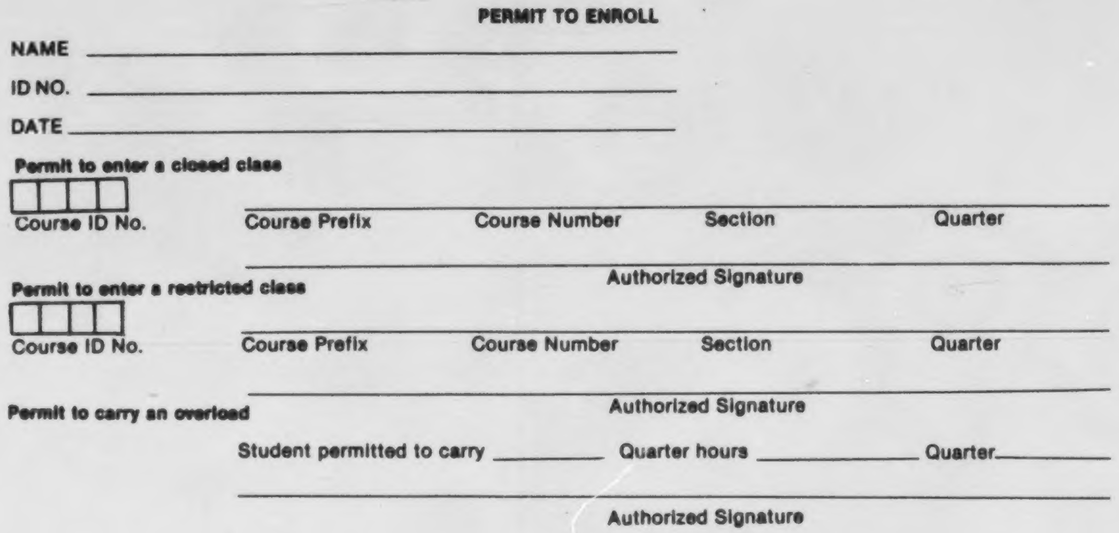
DATE

STUDENT SIGNATURE

ADVISOR SIGNATURE

APPENDIX A

.3



PERMIT TO ENROLL

NAME ____________________

ID NO. ____________________

DATE ____________________

Permit to enter a closed class

☐☐☐☐ Course ID No. — Course Prefix — Course Number — Section — Quarter

Authorized Signature

Permit to enter a restricted class

☐☐☐☐ Course ID No. — Course Prefix — Course Number — Section — Quarter

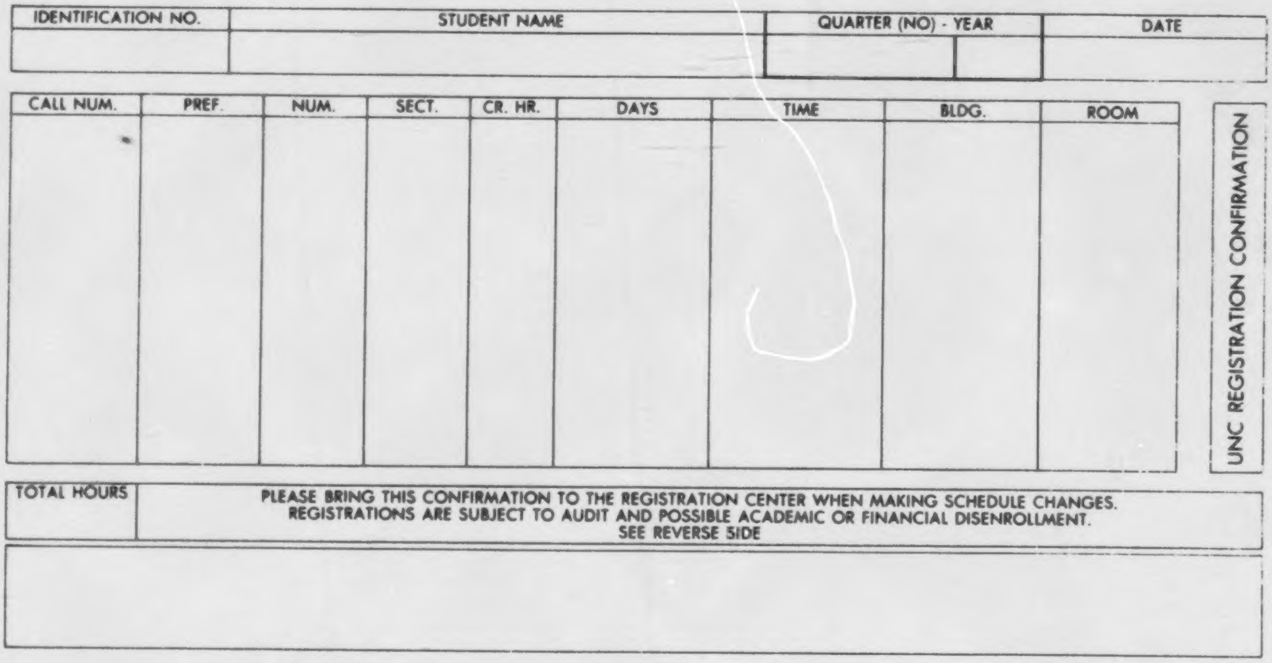
Authorized Signature

Permit to carry an overload

Student permitted to carry ________ Quarter hours ____________ Quarter________

Authorized Signature

.4



IDENTIFICATION NO.	STUDENT NAME	QUARTER (NO) - YEAR	DATE

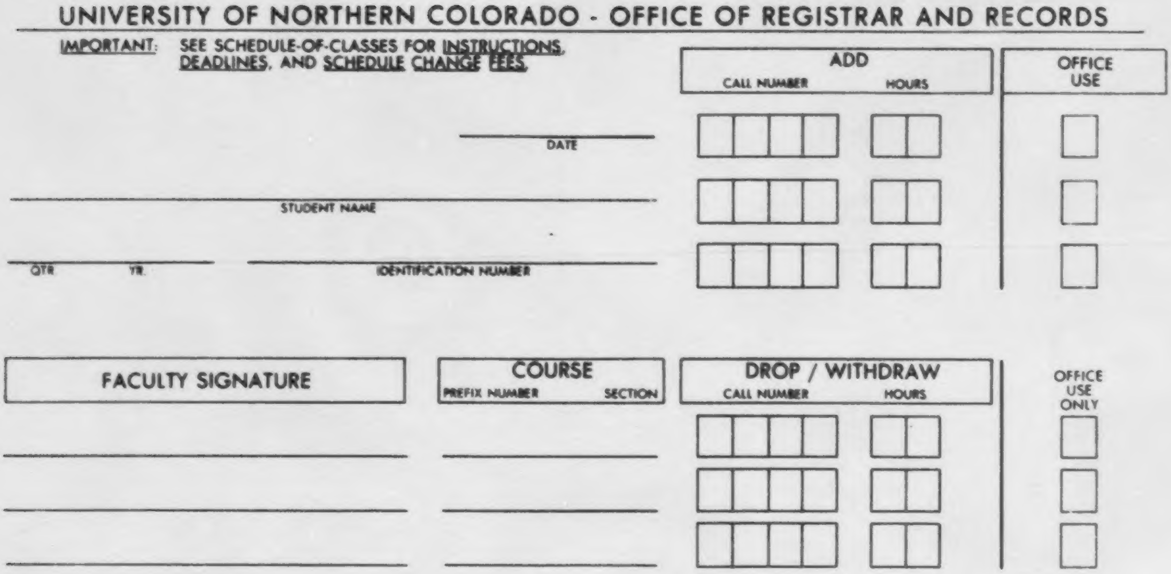
CALL NUM.	PREF.	NUM.	SECT.	CR. HR.	DAYS	TIME	BLDG.	ROOM

UNC REGISTRATION CONFIRMATION

TOTAL HOURS	PLEASE BRING THIS CONFIRMATION TO THE REGISTRATION CENTER WHEN MAKING SCHEDULE CHANGES. REGISTRATIONS ARE SUBJECT TO AUDIT AND POSSIBLE ACADEMIC OR FINANCIAL DISENROLLMENT. SEE REVERSE SIDE

APPENDIX A

.5



UNIVERSITY OF NORTHERN COLORADO - OFFICE OF REGISTRAR AND RECORDS

IMPORTANT: SEE SCHEDULE-OF-CLASSES FOR INSTRUCTIONS, DEADLINES, AND SCHEDULE CHANGE FEES.

DATE

STUDENT NAME

QTR YR. IDENTIFICATION NUMBER

ADD		OFFICE USE
CALL NUMBER	HOURS	
☐☐☐☐	☐☐	☐
☐☐☐☐	☐☐	☐
☐☐☐☐	☐☐	☐

FACULTY SIGNATURE	COURSE PREFIX NUMBER SECTION	DROP / WITHDRAW CALL NUMBER	HOURS	OFFICE USE ONLY
		☐☐☐☐	☐☐	☐
		☐☐☐☐	☐☐	☐
		☐☐☐☐	☐☐	☐

EXPERIENTIAL BASED TRANSCRIPTS AND A TEST ITEM DATA BANK: DISTRIBUTED COMPUTING APPLICATIONS

Jesse C. Edwards, M.S., University of Nebraska Medical Center
Donald F. Costello, M.S., University of Nebraska at Lincoln
Thomas F. Gallagher, M.D., University of Nebraska Medical Center

ABSTRACT

Beginning with a brief definition of the physician assistant concept this paper then reports on the design development of a minicomputer based information system for physician assistant students. Three separate projects are described. The paper first describes a system built on modern concepts of experiential based learning and data processing requirements levied by that kind of an educational program. It continues with the description of the production and maintenance of transcripts based on these experiences. Changes in academic curriculum occasioned by reviewing statistical reports of recorded experiences are discussed. Then the experiences in providing this kind of student record keeping to other physician assistant programs is presented.

A second project, the cooperative building of a test item bank particularly designed for physician assistants is reported. Discussion of the taxonomy used to categorize physician assistant student experiences and the connecting link to the test item bank is included.

Thirdly, there is a description of a Computer Assisted Instruction (CAI) curriculum.

The activities and future plans associated with the integration of these three projects completes the paper.

CREDITS

Funding for work on this project was provided in part by Bureau of Health Manpower, DHEW, Grant No. 5 D21PE17008; by the University of Nebraska Computing Network, and the University of Nebraska College of Medicine. Important contributions to the system design were made by Christie Thorpe and Joan Rostermundt, UNMC Physician Assistant Program. Programming was mainly done by Leonard Campbell, University of Nebraska Computing Network.

PHYSICIAN ASSISTANTS: A DEFINITION

In the early 1960s a deep concern of medical manpower policy makers about the perceived shortage of physicians and the availability of medical care, especially in the rural and inner city areas, led to the development of a new type of medical practitioner. It was then a widely held belief that returning Vietnam military medical corpsmen could, with additional education and training, assume responsibility for much of the care traditionally provided only by physicians. This belief, coupled with a belief that these new practitioners would be less costly providers, gave impetus to the training of physician assistants (PAs). With encouragement and financial support by the federal government, organized medicine, and medical educators, physician assistant educational programs were established in almost every state. In response to the problem of maldistribution of physicians in the state's rural areas, the Nebraska State Legislature mandated the University of Nebraska Physician Assistant Program in 1971. Students included not only ex-medical corpsmen but also persons from civilian health care occupations such as nurses, respiratory therapists and medical laboratory technologists.[1]

This group of non-physician medical care providers is expected, under a physician's general supervision, to diagnose and manage a wide variety of common medical problems.

A review of available research data indicates PAs are assuming a significant role in the delivery of health care and by so doing are improving patient access to care. PAs are providing quality care, are productive, cost-effective, and are well accepted by patients and employing physicians.

ROLE DELINEATION AND CURRICULUM DESIGN

The creation of a new health professional required careful consideration to identify the tasks and responsibilities of the graduate and to design a curriculum that would meet the educational needs of these practitioners. The resulting role delineation had to meet approval of the physicians under whose guidance the graduate would serve. It was also critical that the clients served by the PA accept such care. An early study identified over 300 competencies essential to this new role.[2] A later study confirmed the validity of the task list.[3]

In 1980, fifty-six PA educational programs existed, graduating about 1500 PAs yearly. The typical PA program is a two year baccalaureate degree program based in a medical school. Commonly, PA program curricula comprise two basic components. The first component, formal didactic instruction, includes coursework in basic medical science, applied behavioral science, data gathering, and clinical medicine. In most programs this phase lasts from 6 to 12 months. The second major component, structured clinical rotations, comprise experiences in inpatient and outpatient clinical settings with particular emphasis on primary care. The range of this training is anywhere from 9 to 15 months in nearly all programs.[4]

It is the second component of the curricula that poses special challenges in physician assistant education. Typically, program administrators assign the students to a variety of clinical sites within and outside the institution. It is expected students will receive a quality education from competent teachers who expose the student to patients with a variety of medical problems which should be appropriately managed by PAs. This apprenticeship system is as old as medicine. However, a very real problem centers around monitoring these field experiences which are subject to a multitude of variables. A major dilemma is finding out what medical problems are being seen by the student and how to test for the student's competency in managing those encounters.[5,6]

In an earlier paper the authors discussed the system design interaction that took place in early efforts to computerize the data collection aspects of managing student field encounters.[7] The current paper elaborates on the finalization of the data collection, utilization of the reports by students, faculty, and curriculum planners and describes the development of a testing system to measure certain student experiences. It also describes the use of Computer Assisted Instruction (CAI) in the PA curriculum.

PAPER SYSTEM: Physician Assistant Progress and Evaluation Report

At the outset, PA programs adopted a typical model of medical education. But, because they were unimpeded by tradition, the new programs were afforded a rare opportunity to introduce innovations. Time-tested and proven educational methodologies and techniques could be applied. The long tradition of clinical clerkships (field experiences) could be modified and improved by documentation and measurement of specific objectives achieved.

Monitoring the type and quality of these experiences is a time consuming and nearly impossible task. Because these field experiences are so valuable, some mechanism is needed by the student, the training field physician, and the home educational institution to provide feedback to permit adaptive modification of the field experiences.

These observations contributed to the design of PAPER, an acronym for Physician Assistant Progress and Evaluation Report. This computerized system provides an experiential based transcript which shows in some detail the field experiences of the PA student. Input into the system is from a record initiated by the student after each patient encounter (Figure 1). These experiences are categorized in accordance with a taxonomy that has evolved over the three year life of the system. This current taxonomic description has been adapted from the International Classification of Diseases (9th revision) thereby increasing the value of the outputs as a research data base as compared to the earlier version of this system.

The primary output is a summary of the students' experiences - an experiential transcript (Figure 2). It includes data for the current month as well as a year-to-date record of all experiences seen thus far.

Other outputs include a report which collectively summarizes the experiences occurring at each of the training sites and a summary report for all students.

Utilization of Outputs

The physician community, not to mention the consumer, is appropriately concerned about, and sensitive to, the delegation of selected medical services to non-physicians. It is unlikely any other profession has evolved under the watchful eyes of so many groups, including not only physicians, but nurses, pharmacists, and a plethora of allied health professionals. Therefore, serious attention had to be given to the systems design that would support such an important student record keeping effort.

The transcript has become important to the student in a variety of ways. Timely feedback allows the student to determine his/her progress in the educational program compared to a previously provided list of behavioral objectives. The report is then useful in negotiating with the physician teacher for exposure to patients with certain medical problems. Such action serves to broaden and deepen the student's field of experiences.

A summarized copy of this transcript at time of graduation provides each student with meaningful documentation of all clinical encounters. This is useful in job hunting to demonstrate the precise nature of one's education, gain clinical privileges in hospitals and obtain credentials from medical boards who regulate the PA's scope of practice.

The summary report for each training site is used to assess the range of experiences provided the students at those sites. If deficiencies occur, the educational coordinators attempt to negotiate with the supervising physician for appropriate changes.

Finally, since the student information systems design is aimed at closely coupling field experiences with previously established behavioral objectives, the summary picture of what each student has accomplished is useful to educational coordinators. Educational experiences can be structured to be certain that gaps resulting from uncontrollable field situations are closed prior to graduation. In one instance the transcript served as an administrative device to convince a student to extend her formal education by three months.

Programming

The programming done as a part of this system was accomplished in APL on an IBM 5110. Algorithmic debugging of the code was performed on the VM/CMS version of APL and served as a repository for the backup version of the code. This plan did not prove as fruitful as first believed because of the singular qualities of the minicomputer output screen and associated printer device. Use of the VM/CMS system as a developmental expedient, backup vehicle, and production machine is still being pursued. The current unsatisfactory nature of the communication protocols between the minicomputer and the host has been discouraging. The cost of developing this environment is too expensive to be borne by a single client and more satisfactory systems software is expected from the field or the vendor.

The choice of APL as a development language is a subject of much debate. Literature does suggest that the compact nature and power of the language lends itself to certain administrative applications.[8] Systems designers and users of this system believe that APL is a powerful language and should be a serious candidate for a production language in certain administrative applications.

Comments

The PAPER system has become an important evaluative tool. It has been of value to students, physician teachers and curriculum planners. Other educational programs of a similar nature were informed of the system's capabilities[9] and seven have chosen to become involved with the system. These programs send their input forms to Nebraska and receive monthly output reports in the mail. At least two other programs have reproduced modified versions of the system using local computer capabilities. At present the production workload is beginning to strain this component of the total PA computer system efforts. Future plans to cope with this success are described later in this paper.

MR. TIB SYSTEM: Test Item Bank

A number of health related disciplines have developed computer based test item banks to assess student progress and achievement in specific curriculum areas.[10,11,12] From the inception of the Nebraska PA Program its administrators recognized the value of such a data retrieval system for physician assistant education. The time and effort required for the creation of a valid and acceptable system was beyond the scope of one program; therefore, a cooperative venture was undertaken by several PA programs.[13] The result is a system, affectionately known as MR. TIB, which is used by twenty-eight of the nations fifty-six PA programs. The number of users is expected to increase to at least forty. The bank currently contains over 1,700 quality items with another 2,000 in varying stages of review. The cooperative nature of this project (over 100 persons have contributed) represents a major milestone in the sharing of educational expertise by a widely dispersed group of PA educators. The savings to participating programs in terms of brainpower and word processing is of particular significance and most physician assistant educators acknowledge it to be a godsend in helping with their evaluation efforts. Currently the computer outputs from MR. TIB consist of: 1) multiple choice test item sheets, 2) indices in three formats, and 3) printed tests. Future plans call for the addition of a behavioral objectives bank correlated with the test items. A detailed description of MR. TIB appears elsewhere.[14]

INTERDIGITATION OF PAPER AND MR. TIB

The two systems described thus far are important interlocking components of the educational program at Nebraska. PAPER provides an efficient method of coping with the universal problem of assuring to a greater extent that students are getting field experiences which parallel their future practice. MR. TIB allows for the quick and easy generation of examinations which are helpful in measuring the cognitive knowledge relating to the field experiences. The taxonomy of experiences for PAPER and MR. TIB are one and the same. This has several advantages, a major one being the ability to generate examinations specific to a student's field experiences.

A THIRD COMPONENT: Computer Assisted Instruction (CAI)

At Nebraska the two previously described computer systems are supplemented by a third system - computer assisted instruction. MR. TIB and PAPER have been useful in identifying student academic shortcomings. A valuable supplemental teaching tool to help with this problem has been the CAI courseware available on a subscription basis from the Ohio State University College of Medicine and the Massachusetts General Hospital. Aided initially by a grant from the University of Nebraska Computing Network the PA program over a three year period developed a CAI curriculum including 46 computer simulations which relate to the field experiences of physician assistant students. It takes about fifty hours for a student to complete the simulating. These simulations vary in the richness of interaction. They provide the usual advantages of CAI, a variety of simulated patients, allow for the development of skills in clinical judgment, and provide the opportunity to be responsible for "patients" without student anxiety or danger to the patient.

CAI has proven popular with the students. It has provided the teaching staff with a method of assessing the medical decision-making processes of the pupil. Additionally, selected programs have been included in the extensive summative evaluation used by the program.

FUTURE PLANS:

The use of computers in physician assistant education has matured to the point that they are an indispensable component in many PA curriculas. It is now time to reflect on the current system performance and plan future system modifications.

The PA computer development took place as a result of the same pressures that caused minicomputer development to take place in other university departments around the country. The PA program itself was an isolated system. Its student information was not an essential part of a whole university information system. The PA program staff wanted local control of system design, program development, program modification and a whole range of important operational activities such as data entry and report generation.

The success of the system has generated the same growth problems found in other computing environments. System stability is becoming an important factor in the operation because the system needs to be up and running almost all the time. With many external users, system modification and system enhancement suggestions come not only from the internal staff but also from many users around the country. The development of more effective and efficient production techniques is an important activity in the immediate future.

As the PA program staff desired local control, some of the users are now expressing that same desire. The problem is how to provide remote users local control and still insure that the standards (PAPER experiences and MR. TIB items, for example) necessary to maintain credibility are maintained. The design of a system that distributes some functions and provides a reasonable amount of local control is a future design goal.

Investigation of more extensive uses of the computer communication capability inherent in our current system will also occupy the future design efforts. The project will investigate the more profitable utilization of larger computer equipment to permit such computationally expensive programs as a KWIC index generator. The ability to meaningfully communicate with similar and smaller remote minicomputers will also be investigated.

Finally, the design of a truly meaningful data base approach to a total system view of the PA program's teaching and learning activities will be investigated. The two major systems provide a natural link to each other through a common taxonomy. Data design, based on this taxonomy as the root of the PA educational program, seems rich in possibilities.

Some Final Comments

The evolutionary system described in this paper is of particular value because it addresses problems which are not unique to physician assistant education. Adaptation for any health profession is simple, obvious, and had been undertaken within our own School of Allied Health Professions. Author Costello is developing a similar field documentation program for computer science students.

The projects have clearly demonstrated some advances which can be made by sharing of educational expertise. Students, practicing physician teachers, and varied university faculty have without question provided enthusiastic support and improved the credibility and value of the test item bank.

Almost all PA programs manually tabulated field experiences and examinations in early years. Rapid computer reporting has generated an infectious enthusiasm for what once was an onerous chore. The ease and flexibility of tabulating, analyzing and collating reports and preparing examinations has sparked many productive teacher/student activities.

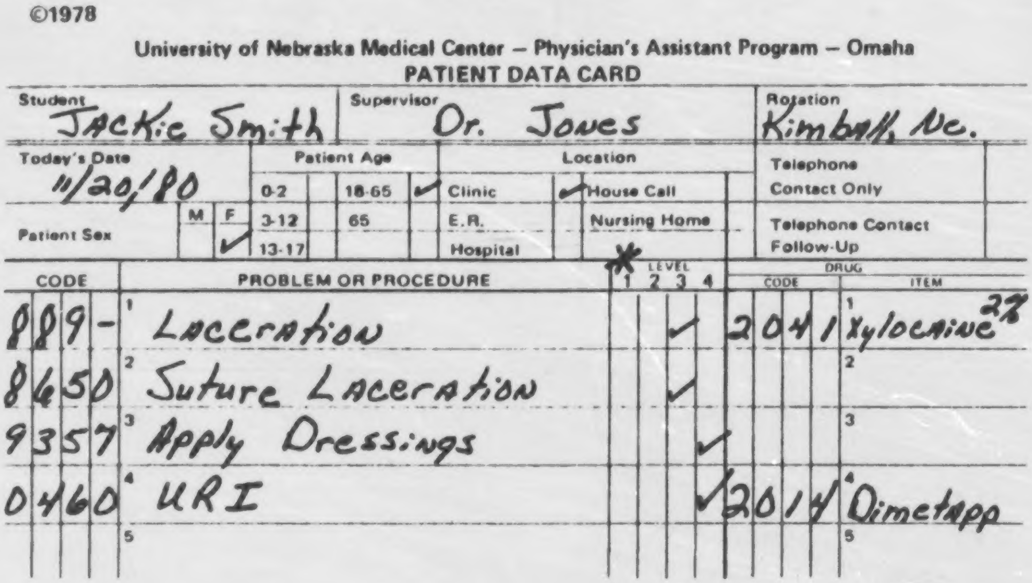
Naivety and insecurity prevented faculty involvement in early computer projects. With the successful introduction of these manageable programs, inquiry has been stimulated, new demands created and many independent projects are being planned for the future.

This experience has enriched the professional life of PA program staff by providing a deeper appreciation for the potential value of computers in medical education. Also, local computing specialists have been afforded an opportunity to gain useful insights into the health professions.

And finally, this work draws attention to the potential for cost savings which could be realized by widespread use of such a jointly developed and distributed system.

FIGURE 1

STUDENT INPUT TO PAPER SYSTEM



©1978

University of Nebraska Medical Center – Physician's Assistant Program – Omaha

PATIENT DATA CARD

Student JAcKie Smith	Supervisor Dr. Jones	Rotation Kimball, Ne.

Today's Date 11/20/80			Patient Age			Location			Telephone Contact Only
			0-2	18-65 ✓		Clinic ✓	House Call		
Patient Sex	M	F ✓	3-12	65		E.R.	Nursing Home		Telephone Contact Follow-Up
			13-17			Hospital			

CODE	PROBLEM OR PROCEDURE	*LEVEL 1	2	3	4	DRUG CODE	DRUG ITEM
889-	1 Laceration			✓		2041	1 Xylocaine 2%
8650	2 Suture Laceration			✓			2
9357	3 Apply Dressings				✓		3
0460	4 URI				✓	2014	4 Dimetapp
	5						5

INSTRUCTIONS:

A card is completed for each patient encounter and mailed to PA program office daily. Codes are added by clerk.

*Definition of Responsibility Levels:

Level 1. Patient referred immediately to M.D.

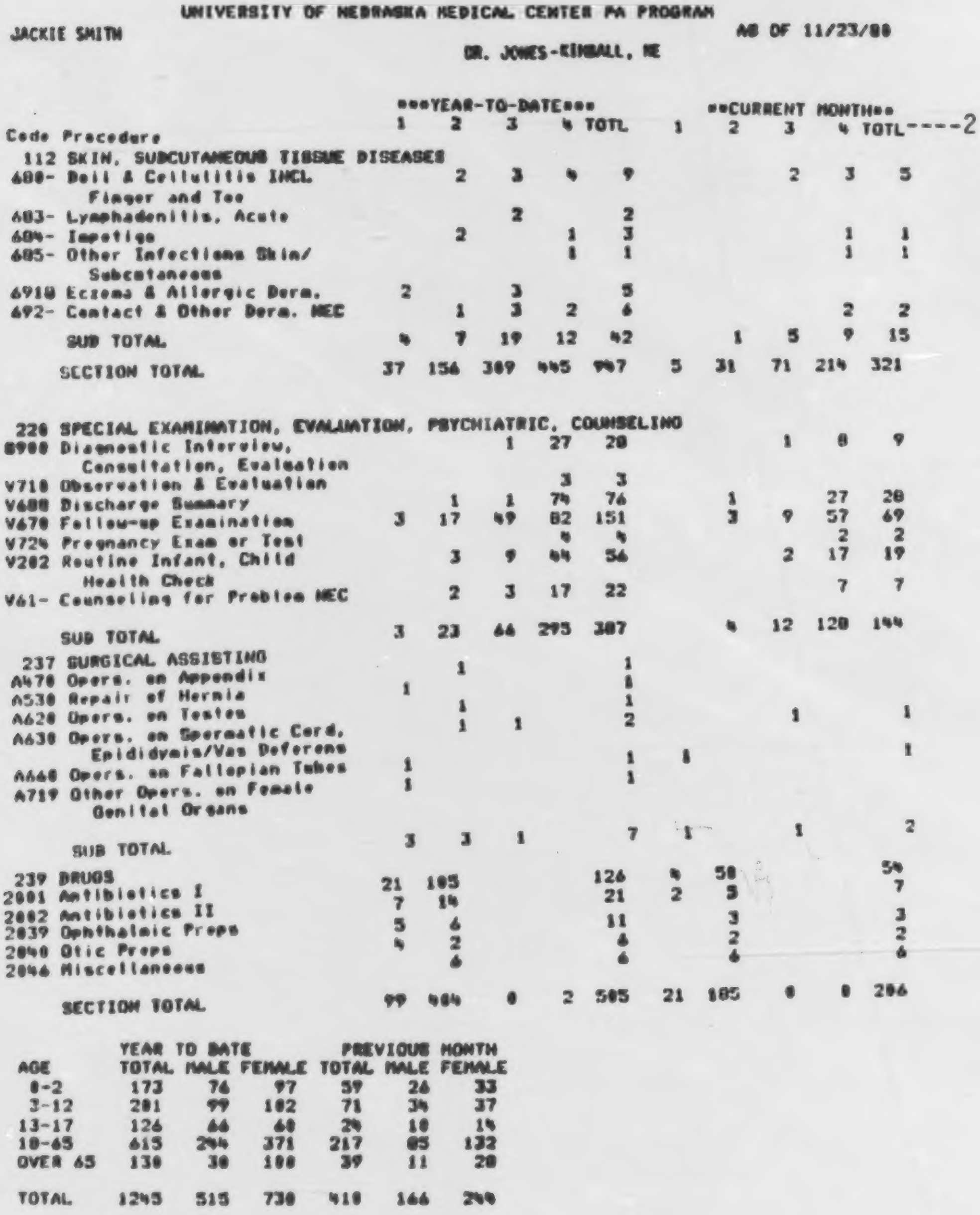
Level 2. Patient referred to M.D. after history, physical exam, and ordering of tests.

Level 3. PA proposes management plan and therapy for the problem, but consults with M.D. before implementation.

Level 4. PA selects a management plan and decides on therapy without mandatory consultation with M.D. before implementation.

FIGURE 2

STUDENT EXPERIENTIAL TRANSCRIPT [1]



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                     UNIVERSITY OF NEBRASKA MEDICAL CENTER PA PROGRAM
JACKIE SMITH                                                         AS OF 11/23/88
                                          DR. JONES-KIMBALL, NE

                                            ***YEAR-TO-DATE***           **CURRENT MONTH**
                                          1     2     3     4  TOTL     1     2     3     4  TOTL----2
Code Procedure
 112 SKIN, SUBCUTANEOUS TISSUE DISEASES
680- Boil & Cellulitis INCL                     2     3     4     9                 2     3     5
        Finger and Toe
683- Lymphadenitis, Acute                             2           2
684- Impetigo                                   2           1     3                       1     1
685- Other Infections Skin/                                 1     1                       1     1
        Subcutaneous
6910 Eczema & Allergic Derm.              2           3           5
692- Contact & Other Derm. NEC                  1     3     2     6                       2     2

     SUB TOTAL                            4     7    19    12    42           1     5     9    15

     SECTION TOTAL                       37   156   309   445   947     5    31    71   214   321


 220 SPECIAL EXAMINATION, EVALUATION, PSYCHIATRIC, COUNSELING
8900 Diagnostic Interview,                            1    27    28                 1     8     9
       Consultation, Evaluation
V710 Observation & Evaluation                               3     3
V680 Discharge Summary                          1     1    74    76           1          27    28
V670 Follow-up Examination                3    17    49    82   151           3     9    57    69
V724 Pregnancy Exam or Test                                 4     4                       2     2
V202 Routine Infant, Child                      3     9    44    56                 2    17    19
       Health Check                                                                       7     7
V61- Counseling for Problem NEC                 2     3    17    22

     SUB TOTAL                            3    23    66   295   387           4    12   128   144
 237 SURGICAL ASSISTING                                           1
A470 Opers. on Appendix                         1                 1
A530 Repair of Hernia                     1                       1
A620 Opers. on Testes                           1                 2                 1           1
A630 Opers. on Spermatic Cord,                  1     1
       Epididymis/Vas Deferens                                    1     1                       1
A660 Opers. on Fallopian Tubes            1                       1
A719 Other Opers. on Female               1
       Genital Organs

     SUB TOTAL                            3     3     1           7     1           1           2

 239 DRUGS                               21   105               126     4    50                54
2001 Antibiotics I                        7    14                21     2     5                 7
2002 Antibiotics II                       5     6                11           3                 3
2039 Ophthalmic Preps                     4     2                 6           2                 2
2040 Otic Preps
2046 Miscellaneous                              6                 6           6                 6

     SECTION TOTAL                       99   404     0     2   505    21   105     0     0   206

            YEAR TO DATE          PREVIOUS MONTH
AGE         TOTAL MALE FEMALE TOTAL MALE FEMALE
  0-2         173   76     97    59   26     33
  3-12        201   99    102    71   34     37
 13-17        126   66     60    24   10     14
 18-65        615  244    371   217   85    132
 OVER 65      130   30    100    39   11     28

 TOTAL       1245  515    730   410  166    244
```

---

1. This is a modified version of a multi-paged report. It is for illustration only.

2. See Figure 1 for explanation of code lists.

REFERENCES

1. Todd, M. & Foy, D.: Current Status of the Physician Assistant and Related Issues, Journal of the American Medical Association, 13: 1714-1720, 1972.
2. Division of Physician Assistant Education, University of Nebraska Medical Center, Omaha, Nebraska: The Physician Assistant: An Occupational Analysis, September, 1976, (pg. 77).
3. American Academy of Physician Assistants, Arlington, Virginia: Final Report - Curriculum Resource Document, December, 1976.
4. Golden, A. & Cawly, J.: A Survey of Curricula for Physician Assistants, Association of Physician Assistant Programs, October, 1980, (unpublished).
5. Tworek, R.: Developing and Organizing a Physician Assistant Preceptorship, PA Journal, 6(3):147-154, Fall, 1978.
6. Heller, L., Fasser, C., Middleton, J.: "A Problem Oriented Journal As A Method Of Evaluating Clinical Experiences of Physician Assistants", The PA Journal, 6(3):141-146, Fall, 1976.
7. Edwards, J. & Costello, D.: Using a Computer To Aid in Evaluating the Occupational Activities of a Student's Progress in A Physician Assistant Program. Proceedings of the Seventeenth Annual Convention of the Association For Educational Data Systems, Detroit, Michigan, 1979.
8. Carlson, Walter, M.: The APL Phenomenon in IBM, GUIDE-41, Proceedings, 1975.
9. Edwards, J., et. al.,: "Tracking and Testing: A Computerized Approach for Physician Assistants." Workshop at Seventh Annual Physician Assistant Conference, Hollywood, Florida, April 25, 1979. (Mimeographed.)
10. Willoughby, T.: Evaluating the Information Base of Students in Health Science Programs. Presented at the annual meeting of Southeastern Psychological Association, New Orleans, Louisiana, 15 p., 1976.
11. Small, N.W., M.D., "A Profile Examination System for Physician Extenders and a Method For Curriculum Prescription," Final Report 1977, University of Missouri - Kansas City School of Medicine.
12. Sivertson, S., Hansen, R., Schounewberger, A.: "Computerized Test Bank For Clinical Medicine," Educational Technology, 13(3): 38-39, March, 1973.
13. Edwards, J., Thorpe, C., Gallagher, T.: "Mr. TIB: A Cooperative Effort Toward PA Evaluation," Physician Assistant and Health Practitioner, 4(11): 54-55, November, 1980.
14. Division of Physician Assistant Education, University of Nebraska Medical Center, Omaha, Nebraska: 1979-1980, Annual Report - Mr. TIB, May, 1980.

A SUCCESSFUL AUTOMATED ON-LINE TRANSCRIPT SYSTEM

Tony Barnfather and Fred Rosmanitz
The University of Calgary
Calgary, Alberta, Canada

The Academic Transcript System at the University of Calgary is a successful application that combines on-line and batch processing to generate student transcripts.

Since implementation of the system in December 1979, the Transcript Office has reduced their manpower from 4½ to 2½ full-time equivalent employees (F.T.E.'s). A further reduction to 2 F.T.E.'s is anticipated in the near future.

The system uses the University's integrated Student and Course Data Bases as the source of information for academic transcripts. Requests for transcripts are processed on-line and stored in a Request Data Base. As part of the request process a student can specify critieria that must be satisfied before the transcript is to be issued. In addition, many requests are received weeks or even months in advance of when the transcript is to be released. Controlling thousands of advance requests with differing criteria was a time-consuming and complicated clerical task. The new system has been designed to manage these requests and to automatically print transcripts at the appropriate time.

In addition to the improved service to students and alumni, the Registrar's Office has been able to make significant reductions in its operating budget and increase the productivity of the Transcript Office.

INTRODUCTION

The University of Calgary is located in the mid-western province of Alberta, Canada. Alberta which is celebrating its 75th birthday this year, is known for its vast oil and natural gas resources. The city of Calgary, situated in the foothills of the Canadian Rockies, is the province's financial centre, but is best known for the annual Calgary Stampede. Due largely to the oil boom, the city's population has grown from 320,000 in 1966 to over 500,000 in 1979.

The University of Calgary is one of four universities in Alberta and is funded largely by provincial government grants. Previously affiliated with the University of Alberta, the University of Calgary gained full autonomy in 1966 and since then has grown in size from an enrollment of 4,000 to the current full and part-time enrollment of 14,000 students. The University offers a wide range of undergraduate, graduate and professional programmes including Engineering, Law, Medicine, Environmental Design and Geology and Geophysics.

The systems development and computer processing for administrative departments is provided by the Department of Administrative Systems. The department has a staff that includes 19 programmer analysts, 3 systems programmers and 15 operations personnel. The administrative computer is an IBM 370-148 with 2 megs of memory and OS/VS1 operating system. System development software includes IMS data base management system, CICS teleprocessing monitor, and ROSCOE program development aid. COBOL is the primary programming language. The department has developed, and maintains over fifteen major systems covering a wide range of University activities. These include a Student Information System (SIS), Financial and Budget Information System, Library Acquisition and Circulation Systems, Payroll/Personnel System and Media Resource Reservation and Scheduling System amongst others.

The Registrar's Office with a staff of 40 full-time employees is responsible for Admissions, Registrations, Examinations, Grade Collection, Timetabling, Room Reservations, Convocation as well as Records and Transcripts. The systems support to help meet these responsibilities is provided by an integrated Student Information System that incorporates both batch and on-line updating. The direction of development of the Student Information System is the ultimate responsibility of the Registrar's Office. The Student Information System has changed considerably in recent years progressing from a tape based system with batch only applications, to an integrated data base system with batch and on-line applications. The primary SIS Data Bases are the "active" and "inactive" student master files containing academic records for 80,000 students, and the course master file containing timetable information for 30,000 courses for past and current sessions. The "active" Student and Course Data Bases and summary information for "inactive" students are on-line.

Some of the more recent on-line development includes student admission, student registration, student timetables and grade collection. Also an on-line Student Accounts Receivable System is scheduled for implementation in the Spring 1981. The Automated Transcript System is one of the latest completed phases of SIS development, and the rest of this document is devoted to describing this system.

SYSTEM OBJECTIVES

The primary reasons for developing a new Transcript System were to reduce the cost of providing transcripts and to improve the service to the students and alumni. In a time of increasing operating costs, the Transcript System was identified as one area where significant cost savings could be made. The old Transcript System required the equivalent of 4.5 full-time support employees. Transcripts were produced by photocopying computer printed student record cards. Record cards were printed at the end of each session for all active students and then filed. This filing activity alone required 1800 hours of man effort each year and has been eliminated by the new system. A summary of objectives set for the new system were as follows:

(a) reduce the cost of producing a transcript;
(b) improve the overall service to the students and alumni;
(c) mail transcript within 24 hours of receiving request;
(d) produce transcripts on demand for urgent requests;
(e) produce a transcript that contains a high level of detail including course description, current GPA's, course weights, grade point values, high school courses used for admission, advance credits, previous degrees and free format academic rulings appearing in chronological order;
(f) produce a verification copy of the transcript to be sent to the student, listing when and to whom the official transcripts were mailed;
(g) minimize the risk of forgery by redesigning the transcript document; and
(h) manage outstanding requests to determine when transcripts are ready to be printed (i.e. after grades are recorded).

With these objectives in mind a new automated system was developed that provides on-line processing and management of requests, overnight batch printing of transcripts, and when required, on-line printing of transcripts.

SYSTEM DESCRIPTION

REQUESTING TRANSCRIPTS

Transcript requests are submitted to the Records Section of the Registrar's Office by students, alumni and some University departments. In 1978 a total of 16,000 requests were received for 27,000 transcripts to be issued. Of these about 60% were received through the mail.

The University of Calgary issues two types of transcript, "official" and "unofficial." "Official" transcripts are not issued to students and can only be mailed directly from the Registrar's Office to a specified recipient such as a company or another educational institution. If the student requires a transcript for himself, an "unofficial" transcript can be issued, clearly marked as being "unofficial" and "issued to student."

On the request form the student specifies the name and address of the recipient, the type of transcript to be issued and when it is to be produced. As you can see from the sample request form in the appendices, a student has the option of requesting that the transcript be produced immediately; or after final results from the current session are recorded, or after deferred final exam results are recorded, or after the convocation ceremony when the degree earned is recorded. A large percentage of all requests are received in advance of the date the transcript is required.

Upon receipt of a request, the Records Section immediately enter the information into the system through an on-line computer terminal. (A simulated "request screen" is included in the appendices). The entry process edits the information, determines if a transcript payment is required, stores the request on the Request Data Base, and advises the terminal operator of any "withholds" on the student's file. A request is automatically put on "hold" by the system, if the student does have "withholds." The "hold" can however, be overridden by the terminal operator if required. Once a request has been entered to the system, the form is filed by date of receipt, and normally should not be required again. Should a student enquire as to the status of his request, the "Request Data Base" can quickly be viewed on-line, instead of locating the request form.

PRODUCING TRANSCRIPTS

The majority of transcripts produced by the system are printed in a batch mode. Because of the high volume of transcripts produced, this mode of operation is more cost effective than on-line printing would be. In addition there is little benefit gained by the student if the transcript is produced on-line, because only a small percentage of the requests submitted in person are for transcripts that are required immediately. Nonetheless a transcript can be produced on-line, if the Registrar's Office determines that the circumstances are justified.

The batch application to produce transcripts is run every night. The system scans the Request Data Base selecting requests that are ready for processing based on the "print options" specified by the student. When a request is selected, the system retrieves the student's records from the Student Data Base, the address of the recipient from the Request Data Base and subsequently prints the required number of transcripts. When an official transcript is printed, an unofficial or verification transcript is also printed for issue to the student. The verification copy contains the names and addresses of the official transcript recipients and the date that the transcript was printed. This acts as a confirmation to the student that his request has been processed, and also provides the student with an opportunity to verify the accuracy of his academic record.

If a decision is made to produce a transcript on-line, the terminal operator overrides the "batch" default when entering the request to the system. For a student whose records are on the "active" data base the transcript is immediately generated and routed to the Registrar's Office on-line printer.

For a student whose records are on the "inactive" data base the system displays a reference number of a microfiche that contains the student's transcript. The fiche can be retrieved and a microfiche printer used to print the transcript. The microfiche library is always as up-to-date as the students records on the "inactive" data base. This is achieved by moving inactive students to the "active" data base for updating, and then updating the microfiche library when students are purged back to the "inactive" data base.

ISSUING TRANSCRIPTS

Every transcript produced by the system is visually edited for errors or missing data. If a problem is identified the transcript in error is destroyed, the student's record is updated, and a new transcript is printed. To assist the Records Section in dispatching the transcripts the batch system prints the transcript in the following groups: transcripts to be mailed, transcripts to be picked up (unofficial only), and transcripts that require an attachment.

Before mailing, the official transcripts must be signed and sealed. The signature and "seal" is applied to every page of the transcript in its appropriate location. In order to reduce the risk of alteration the new transcript form is designed with a "security screen" similar to a cheque which makes it extremely difficult to change without leaving obvious evidence of alteration.

The name and address of the recipient is printed on the transcript in a location which allows for the use of window envelopes. This subsequently eliminates the clerical task of typing envelope addresses and also avoids the possibility of mailing a transcript to the wrong party.

REPORTING MANAGEMENT INFORMATION

Reports designed to help in the management of the system are printed each time transcripts are produced in a batch mode. These reports include the following:

(a) summary and type of transcripts printed;
(b) summary of requests waiting to be processed;
(c) list of requests on "hold" and reason for "hold";
(d) list of transcripts printed that require attachments; and
(e) list of student record errors that were detected during the printing of transcripts.

The use of these reports is an integral part in the management of the system. For example, the "list of requests on hold" identifies those requests that probably require special attention before they can be processed. The "summary of requests waiting to be processed" identifies future workloads, such as the volume of transcripts that will be printed after grade collection. The Records Section can adjust to the expected workload and notify computer operations of an impending large transcript print.

Approximately three months after a request has been processed it is purged from the Request Data Base and merged to a history file. Although the appropriate applications have not yet been developed the history file will be used to provide accurate statistics on the volume of transcripts printed, who uses the system and when the peak workloads occur.

UPDATING STUDENT RECORDS

A transcript is visually edited for errors after it is printed and will not be issued if found to contain inaccurate information. Manual changes to the transcript are not permitted so the student's computer records must be updated and the transcript reprinted. Because the use of conventional batch updating could take several days to correct a student's records, an on-line update application has been developed. In the event that a transcript for an inactive student is determined to be in error, there will be a small delay before the records can be updated while a batch job is run to move the student's records from the "inactive" to the "active" data base.

The application to update student records on-line is also being used in other areas of the Registrar's Office to correct batch update errors, and in some cases for the initial input of specific student data. However, the application is tailored for the function of correcting records and is not intended to be suitable for all student updating.

The progression into on-line updating has required that these applications be developed with adequate security features to prevent unauthorized use and the accidental destruction of student records. These security features include special sign-on keys restricted to specific terminals and known only by authorized persons. In addition elaborate editing rules and logging of records before and after change help reduce the risk of accidental record destruction and provide the means to regenerate the student records.

COST OF THE SYSTEM

The system was developed using the equivalent of 225 days of manpower. The applications for processing requests and printing the transcripts accounted for 135 man days, while the on-line student record update application accounted for 90 man days. One 3270 type computer terminal was purchased to support the new system. Since implementation this terminal has been used full-time and it is expected that a second existing terminal will be required during the request peaks. It is difficult to fully determine the impact of the system on the main frame, but it is estimated that over 110,000 CICS transactions will be generated by the system annually.

EFFECTIVENESS OF THE SYSTEM

The Automated Transcript System has been in production for twelve months and many of the objectives set out for the new system are already being satisfied. The cost of producing a transcript has been reduced through the decrease in staff required to support the system from 4.5 to 2.5 equivalent full-time employees, and through the elimination of xeroxing costs. An overall saving of $24,000 in operating costs is expected annually. The service to students and alumni, as expected, has also improved. We are meeting the deadline dates as specified by the student, the transcripts are current and up-to-date, and students are being promptly notified as to the status of their requests. Moreover, the staff in the Records Section has enthusiastically accepted the new automated system and are very pleased with its operation.

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THE UNIVERSITY OF CALGARY

OFFICE OF THE REGISTRAR
CALGARY, ALBERTA, CANADA T2N 1N4

▶ INFORMATION TO ASSIST IN EVALUATING TRANSCRIPT ON REVERSE

TRANSCRIPT OF ACADEMIC RECORD

▶

(MRS.) JULIA TURNER - REGISTRAR

SURNAME DOE	GIVEN NAMES JOHN	STUDENT NUMBER 999993	DATE OF ISSUE (YR MO DY) 80-01-28
PREVIOUS NAME		DATE OF BIRTH (YR MO DY) 53-02-18	PAGE 1

ISSUED TO:

CARLETON UNIVERSITY
CHAIRMAN, DEPT. OF PSYCHOLOGY
COLONEL BY DRIVE
OTTAWA, ONTARIO
K1S 5B6

RECORD OF MATRICULATION: AVERAGE: 61.20%

BIOLOGY 30	58%	CHEM 30	64%	ENGLISH 30	68%
MATH 30	56%	SOC STUD 30	54%		

ADMITTED TO THE FACULTY OF ARTS AND SCIENCE WITH CLEAR SENIOR MATRICULATION (ALBERTA 1971).

--COURSE---	------------DESCRIPTION------------	GR	GPV	WGT	GRPTS	UN	GPA
	FALL/WINTER 1973/74 ARTS & SCIENCE						
ENGL 241	ENGLISH LIT CHAUCER TO MILTON	B	3.0	2.0	6.00	3	
GLGY 209	INTRODUCTION TO GEOLOGY	C	2.0	2.0	4.00	3	
PHIL 201	PROBLEMS OF PHILOSOPHY	B+	3.0	2.0	6.00	3	
PSYC 215	BEHAVIOURAL STATISTICS	C	2.0	2.0	4.00	4	
SOCI 201	INTRODUCTORY SOCIOLOGY	A	4.0	2.0	8.00	3	
ANTH 203	SURV TRIBAL & PEASANT SOCIETIES	B+	3.0	2.0	6.00	3	
CLAS 209	CLASSICAL MYTHOLOGY	C	2.0	2.0	4.00	3	
ENGL 243	ENGLISH LIT FROM POPE TO PRESENT	B+	3.0	2.0	6.00	3	
PSYC 205	PRINCIPLES OF PSYCHOLOGY	B+	3.0	2.0	6.00	3	
SOCI 205	CANADIAN SOCIETY	A	4.0	2.0	8.00	3	
						GPA:	2.90
	FALL/WINTER 1974/75 ARTS & SCIENCE BA 20 IN PSYCHOLOGY						
ANTH 315	ETH SURV NW COAST INDIANS	B+	3.0	2.0	6.00	3	
PSYC 353	INTRODUCTION TO GERONTOLOGY	B+	3.0	2.0	6.00	3	
PSYC 361	PRINCIPLES OF LEARNING	A+	4.0	2.0	8.00	3	
SOCI 341	SOCIAL PSYCHOLOGY	A	4.0	2.0	8.00	3	
ANTH 313	CONT INDIAN ISSUES IN CANADA	B	3.0	2.0	6.00	3	
ENGL 384	SURVEY OF CANADIAN LITERATURE	B	3.0	4.0	12.00	6	
PSYC 351	DEVELOPMENTAL PSYCHOLOGY	A	4.0	2.0	8.00	3	
PSYC 381	PERSONALITY	A	4.0	2.0	8.00	3	
SOCI 377	SOCIOLOGY OF RELIGION	A	4.0	2.0	8.00	3	
						GPA:	3.50

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TRANSCRIPT OF ACADEMIC RECORD

393

▶

(MRS.) JULIA TURNER - REGISTRAR

SURNAME DOE	GIVEN NAMES JOHN	STUDENT NUMBER 999999	DATE OF ISSUE YR MO DY 80-01-28
PREVIOUS NAME		DATE OF BIRTH YR MO DY 53-02-18	PAGE 2

--COURSE---	------------DESCRIPTION------------	GR	GPV	WGT	GRPTS	UN	GPA
	FALL/WINTER 1975/76						
LING 201	THE NATURE OF LANGUAGE 1	B	3.0	2.0	6.00	3	
PSYC 315	BASIC PSYCHOLMETRICS & CORREL'N	A-	3.7	2.0	7.40	4	
PSYC 363	MOTIVATION	A	4.0	2.0	8.00	3	
SOCI 343	COLLECTIVE BEHAVIOUR	B+	3.3	2.0	6.60	3	
ENGL 398	CHILDREN'S LITERATURE	C+	2.3	4.0	9.20	6	
LING 203	THE NATURE OF LANGUAGE II	B	3.0	2.0	6.00	3	
PSYC 453	EXPER CHILD PSYC: SOCIAL PERSONAL	A	4.0	2.0	8.00	3	
PSYC 481	EXPERIMENTAL PSYCHOPATHOLOGY	A-	3.7	2.0	7.40	3	
PSYC 485	BEHAVIOUR MODIFICATION	A-	3.7	2.0	7.40	4	
						GPA:	3.30
	SPRING/SUMMER 1976 SOCIAL SCIENCES BA 20 IN PSYCHOLOGY						
NTVE 206	ELEMENTARY CREE	A-	3.7	4.0	14.80	8	
PSYC 503.03	ADOLESCENT PSYCHOLOGY	A-	3.7	2.0	7.40	3	
PSYC 503.04	PSYCHOBIOLOGY	A	4.0	2.0	8.00	3	
SOCI 301	SOCIOLOGY OF SEX ROLES	A	4.0	2.0	8.00	3	
						GPA:	3.82

ADVANCED CREDITS (UNIVERSITY OF ALBERTA, 1976): ONE AND ONE-HALF SR PSYC, ONE SR SOCI.

JUN 1977: AWARDED THE DEGREE BACHELOR OF ARTS (DISTINCTION)
MAJOR: PSYCHOLOGY

--------------------------------END OF TRANSCRIPT --------------------------------

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▶ INFORMATION TO ASSIST IN EVALUATING TRANSCRIPT ON REVERSE

TRANSCRIPT OF ACADEMIC RECORD

**** VERIFICATION COPY ****
**** ISSUED TO STUDENT ****

(MRS.) JULIA TURNER - REGISTRAR

SURNAME DOE	GIVEN NAMES JOHN	STUDENT NUMBER 999999	DATE OF ISSUE YR MO DY 80-01-28
PREVIOUS NAME		DATE OF BIRTH YR MO DY 53-02-18	PAGE 1

ISSUED TO:

JOHN DOE
100 MAIN STREET
FINCHELY, ALBERTA
T2A 0J1

****
* UNOFFICIAL *
****

RECORD OF MATRICULATION: AVERAGE: 61.20%

BIOLOGY 30	58%	CHEM 30	64%	ENGLISH 30	68%
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SOCI 201	INTRODUCTORY SOCIOLOGY	A	4.0	2.0	8.00	3	
ANTH 203	SURV TRIBAL & PEASANT SOCIETIES	B+	3.0	2.0	6.00	3	
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PSYC 351	DEVELOPMENTAL PSYCHOLOGY	A	4.0	2.0	8.00	3	
PSYC 381	PERSONALITY	A	4.0	2.0	8.00	3	
SOCI 377	SOCIOLOGY OF RELIGION	A	4.0	2.0	8.00	3	
						GPA:	3.50

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(MRS.) JULIA TURNER - REGISTRAR

SURNAME DOE	GIVEN NAMES JOHN	STUDENT NUMBER 999999	DATE OF ISSUE YR MO DY 80-01-28
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PSYC 363	MOTIVATION	A	4.0	2.0	8.00	3	
SOCI 343	COLLECTIVE BEHAVIOUR	B+	3.3	2.0	6.60	3	
ENGL 398	CHILDREN'S LITERATURE	C+	2.3	4.0	9.20	5	
LING 203	THE NATURE OF LANGUAGE II	B	3.0	2.0	6.00	3	
PSYC 453	EXPER CHILD PSYC:SOCIAL PERSONAL	A	4.0	2.0	8.00	3	
PSYC 481	EXPERIMENTAL PSYCHOPATHOLOGY	A-	3.7	2.0	7.40	3	
PSYC 485	BEHAVIOUR MODIFICATION	A-	3.7	2.0	7.40	4	
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NTVE 206	ELEMENTARY CREE	A-	3.7	4.0	14.80	8	
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SOCI 301	SOCIOLOGY OF SEX ROLES	A	4.0	2.0	8.00	3	
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JUN 1977: AWARDED THE DEGREE BACHELOR OF ARTS (DISTINCTION)
MAJOR: PSYCHOLOGY

-------------------------------- END OF TRANSCRIPT --------------------------------

THIS IS TO CONFIRM THAT THE ABOVE TRANSCRIPT WAS SENT TO THE FOLLOWING, AS PER YOUR REQUEST:

2 COPIES TO: CARLETON UNIVERSITY
CHAIRMAN, DEPT. OF PSYCHOLOGY
COLONEL BY DRIVE
OTTAWA, ONTARIO
K1S 5B6

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396 RSITY LGARY

REGISTRAR'S OFFICE
2500 University Drive N.W., Calgary, Alberta,
Canada T2N 1N4

REQUEST FOR TRANSCRIP OF ACADEMIC RECORD

PLEASE NOTE:
1 DUE TO THE LARGE VOLUME OF TRANSCRIPT REQUESTS AT THE END OF EACH SESSION, AND BECAUSE THEY ARE HANDLED IN THE ORDER RECEIVED, TWO TO FOUR WEEKS SHOU BE ALLOWED FOR PROCESSING
2 OFFICIAL TRANSCRIPTS ARE MAILED DIRECTLY FROM THE REGISTRAR'S OFFICE TO THE INSTITUTION OR AGENCY NAMED BY THE STUDENT. A VERIFICATION COPY WILL BE MAIL TO THE STUDENT
3 ONLY UNOFFICIAL TRANSCRIPTS ARE ISSUED DIRECTLY TO STUDENTS
4 THE UNIVERSITY OF CALGARY SHALL NOT BE HELD RESPONSIBLE FOR MEETING DEADLINES WHICH ARE NOT THOSE OF THE UNIVERSITY
5 TRANSCRIPT FEE. TRANSCRIPTS OF RECORD ARE PROVIDED FREE OF CHARGE UP TO AN OVERALL TOTAL OF 15 COPIES AND AT $1.00 PER COPY THEREAFTER

STUDENT'S NAME
SURNAME DOE GIVEN NAMES JOHN

STUDENT NO. OR BIRTH DATE 99999 YR. MO. DY.

TODAY'S DATE YR 80 MO 01 DY 27

MAIDEN OR PREVIOUS NAME (if applicable) —

MOST RECENT SESSION ATTENDED
FALL 19___ WINTER 19___ SPRING 1976 SUMMER 19___

When the official transcripts have been released, a verification will be mailed to your current address. To ensure that we have your latest current address, please complete the following:

STREET 100 MAIN ST.
CITY/TOWN FINCHELY
PROV./COUNTRY ALBERTA POSTAL CODE T2A 0J1

STUDENT AUTHORIZATION
I HEREBY AUTHORIZE THE UNIVERSITY OF CALGARY TO RELEASE TRANSCRIPTS OF MY ACADEMIC RECORD.

X John Doe
STUDENT'S SIGNATURE

DETAILS OF REQUEST

OFFICIAL TRANSCRIPTS - MAILED DIRECTLY TO THE FOLLOWING WITH A VERIFICATION COPY ONLY ISSUED TO THE STUDENT.

NAME AND MAILING ADDRESS
CARETON UNIVERSITY
CHAIRMAN-DEPT. OF PSYC
COLONEL BY DRIVE
OTTAWA, ONTARIO
K1S 5B6

INSTRUCTIONS
NUMBER OF COPIES REQUIRED ▶ 2
☑ PREPARE TRANSCRIPTS IMMEDIATELY
☐ HOLD FOR FINAL RESULTS FROM CURRENT SESSION
☐ HOLD FOR FINAL RESULTS FROM ___ SESSION
☐ HOLD FOR DEFERRED FINAL RESULTS FROM CURRENT SESSION
☐ HOLD FOR DEGREE EARNED TO BE RECORDED AFTER JUNE/NOVEMBER CONVOCATION TAKES PLACE
☐ TRANSCRIPTS REQUIRED FOR CONVOCATION AT HOME UNIVERSITY
☐ IF MEETING DEADLINE GIVE DATE REQUIRED ▷ YR. MO. DY.

NAME AND MAILING ADDRESS

INSTRUCTIONS:
NUMBER OF COPIES REQUIRED ▶
☐ PREPARE TRANSCRIPTS IMMEDIATELY
☐ HOLD FOR FINAL RESULTS FROM CURRENT SESSION
☐ HOLD FOR FINAL RESULTS FROM ___ SESSION
☐ HOLD FOR DEFERRED FINAL RESULTS FROM CURRENT SESSION
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☐ TRANSCRIPTS REQUIRED FOR CONVOCATION AT HOME UNIVERSITY
☐ IF MEETING DEADLINE GIVE DATE REQUIRED ▷ YR. MO. DY.

UNOFFICIAL TRANSCRIPTS - ISSUED TO STUDENT ONLY

NO. OF COPIES REQ'D. ▶ 2
☒ I WILL PICK UP
☐ MAIL DIRECTLY TO MY CURRENT ADDRESS

☐ MEETING DEADLINE ▷ DATE REQUIRED YR. MO. DY.

INSTRUCTIONS:
☑ PREPARE TRANSCRIPTS IMMEDIATELY
☐ HOLD FOR FINAL RESULTS FROM CURRENT SESSION
☐ HOLD FOR FINAL RESULTS FROM ___ SESSION
☐ HOLD FOR DEFERRED FINAL RESULTS FROM CURRENT SESSION
☐ HOLD FOR DEGREE EARNED TO BE RECORDED AFTER JUNE/NOVEMBER CONVOCATION TAKES PLACE

☐ CHECK HERE IF YOU HAVE RECORDED FURTHER INSTRUCTIONS ON THE BACK OF THIS FORM.

RO 2/80-09

IMPLEMENTATION OF THE IDEAL STUDENT RECORDS SYSTEM

STEPHEN J. PATRICK
UNIVERSITY OF WISCONSIN - STEVENS POINT
STEVENS POINT, WISCONSIN

This paper will discuss the University of Wisconsin - Stevens Point approach to implementing an ideal student records system. This was done by defining the characteristics of an ideal system and using that model to direct the development and implementation of our new student records system. The ideal presented here may not be applicable for your environment, but it should provide an excellent starting point for your development or thought process.

I. Introduction

The word ideal can be defined as "existing as a mere mental image or in fancy or imagination only" or "one regarded as exemplifying an ideal and often taken as a model for imitation." The word ideal will be used in this paper in the sense of the latter definition.

This paper will discuss the UWSP approach to implementing an ideal student records system. This was done by defining the characteristics of an ideal system and using that model to direct the development and implementation of our new student records system. The ideal presented here may not be applicable for your environment, but it should provide an excellent starting point for your development or thought process.

Although we had initiated development of a new student records system in 1974, our concentrated effort began in the Fall of 1977 when our Chancellor mandated that a new or improved student records system be designed and developed to better serve the students at UWSP. The main criticism of our existing students records system, at that time, was that it was more administrative than student oriented. Also, it was seven years old and was not taking advantage of data base technology or providing a desired degree of integration between application systems.

A campus ad hoc committee was formed to study the problem and propose a solution. The membership of that committee was very broad consisting of representatives from administrative departments, academic departments, and computing services. The committee considered a number of alternatives including modifying our existing application systems, converting the student records system of another institution, and purchasing a system from a software house such as IAI. None of the above alternatives adequately served the needs of the University at an acceptable cost. This led to the decision that the system would be developed in-house. Once this decision was made, the committee needed to develop a strategy for the development of the system. The first step was to identify the characteristics of an ideal student records system. Then, by applying the resource constraints to the characteristics, a conceptual design was developed that would fit in our environment and would approach the ideal as resource levels increase. Finally, an implementation plan was developed. These three steps are described in detail in the resulting Proposal For A Comprehensive Student Records System issued in November 1979. A large part of this paper is based on the contents of that proposal, which received wide exposure and support before implementation was initiated.

Development of the system began in January of 1980, and the first of three phases was installed in July 1980. At this time we are developing the second phase and plan to complete the final phase by the end of 1981. An important premise of the design was, that given the development of a solid student records system that was flexible and generalized, additional applications such as degree audit, transcript production, admissions support and others, could be easily added. This premise provided a manageable sized project for which timetables could be developed yielding tangible results in a timeframe where users realized sufficient results to remain committed to the project.

II. Background

The University of Wisconsin-Stevens Point is one of the thirteen four-year campuses in the University of Wisconsin System. We are located in Central Wisconsin and serve approximately 9,000, predominately undergraduate, students.

The Office of Computing Services dates back to 1965 when tab equipment was installed to support the accounting and grade processing functions. We currently use a Burroughs B6700 to support our academic as well as our administrative functions. Administrative applications are processed using DMSII data base management system in a batch environment with some on-line inquiry. We have a Burroughs B6900 computer on order and expect delivery in spring or summer 1981. The B6900 will enable us to maintain our excellent instructional support and move our administrative applications toward on-line processing.

III. Characteristics of the Ideal Student Records System

The characteristics of the ideal system, described here, were developed to serve as a "benchmark". We may not reach the ideal, but the model will enable us to implement a system as close to the ideal as possible.

A. Integrated

When a student record system is integrated, it maintains common information in a central location that is accessible by all users. If Financial Aids, Accounts Receivable, and Registration have a need for the students address, they will use the same address rather than duplicating the address in three locations. Additionally, the student population is the same for all offices (each office deals with a subset of the entire population), and the problems of reconciling the file of one office with that of another are avoided. Each office will have some student information specific to it, but a large portion of the total data requirements are shared between offices. A parallel to this in a manual system is a student directory where you can find some information about all students in one place.

B. Cumulative

A student record system is cumulative if it stores all the data about a student in essentially one place. The data is organized primarily by student rather than by term. Fixed information such as sex, high school of graduation, birthdate, race, etc. would be collected and stored only one time. Term oriented information such as courses and grade information would be collected, stored, and identified by term, but within the same logical student record as the fixed information.

In drawing a parallel to manual record keeping, a cumulative file is similar to maintaining a file folder for each student. As new information developes it is placed in the file folder.

C. Perpetual

The perpetual characteristic of a student records system refers to the length of time records are kept on file. When students become inactive their records can be moved to a different storage media, but should be retained rather than purged. The records will need to be retained to support the reactivation of students and to support Management Information Reporting. If we had a manual system, the students folder would be removed from the active file cabinet and placed in Archives once they ceased to be students. When students return, their folders would be retrieved from Archives and placed back in the active file cabinet.

D. Flexible

The system must be able to adapt to changes in users requirements. Most systems will function reasonably well doing those things they are designed to do, but a good system will also be able to handle the unexpected and the unusual. During the life of the system new data elements will be needed and coding schemes will change. For example; new majors, a change in the grading scheme, changes in federal and state reporting requirements are just a few of the many things that can and do affect a student record system. The degree to which the system can adapt to any and all of these changes will be a measure of the systems flexibility. In a manual system, the forms in the folders may change, or new types of forms may be required.

Another measure of a systems flexibility is the adaptability of the software. The system must be capable of supporting the appropriate level of data entry, validation, and retrieval. The system must be able to accommodate managements decision whether a particular application is performed in a batch, or an on-line environment. The system should be compatible with expected advances in the state-of-the-art such as distributed processing. Additionally, ad hoc reporting, and general terminal inquiry capability is required to be able to respond to unusual requests for information in a timely manner. New applications will need to be added to the system during the systems life without having a detrimental impact on existing applications.

IV. Development of a Conceptual Design

Designing an ideal student records system would be relatively easy if we had unlimited computer resources, unfortunately we do not. We do have two major resource constraints that influenced the design.

1. The new student records data base could not be designed to consume any more than its current allocation of disk during daytime hours.

2. We could not allocate any additional memory for the data base without impairing the response time of the current mix of work.

The trend in the computer industry appears to be going in the direction of more resources for less cost. The system must be able to easily adapt to modifications of these constraints.

Figure 1 is a schematic of the design of the data base. The design is based on concentric rings with data toward the center being more commonly used with a higher need for availability and data further from the center being the less commonly used data. The rings are divided into pie shaped segments that represent data for the functional areas supported by the student records system.

A. HUB

The center of the design is the HUB. It will contain biographic, demographic and commonly used information about all students who are defined as "active" by one of the functional areas. Accessing records within the HUB will be fast and efficient, and the HUB records will always be available. An additional component of the HUB is an index of all students on file, even though they may not be active.

B. Active

The active ring surrounds and includes the HUB. It will contain the same population as the HUB proper, but the data contained will be function specific, active data, needed in the day to day operation of the administrative offices. For example, student enrollment information for the current term would be in the active ring. At some point that data would no longer be active and it will be moved out to the cumulative ring. The function specific segments of the active ring are independent and do not need to be "on-line" at the same time. Particular segments may even reside on different computers in a distributed processing environment or on a data base machine.

C. Cumulative

The cumulative ring surrounds the active ring. This ring is designed specifically to deal with resource limitations. As computer resources become available the cumulative ring will shrink and eventually disappear with the active ring containing all function specific data concerning "active" students. The cumulative ring is an extension of the active ring and will contain inactive data for active students. It will allow us to further segment the data base to better manage our resources in that this data may not be as available as the HUB and active data.

D. Historical

The historical ring contains all data concerning students that are no longer active. The historical ring would contain records from all components of the other rings. It also provides us with the flexibility to manage our resources in that this data will not generally be readily available.

V. Evaluation Against the Ideal

This section describes how the design described above and summarized in Figure 1 approaches the characteristics of the ideal student record system previously discussed.

A. Integration

Another review of the design schematic will show how integration will be improved. The HUB will include common information used by all the subsystems. The HUB will pull together and replace the unnecessary duplication of data currently spread out across the various subsystems. The active ring will also improve the level of integration. The functional area segments of the active ring will be integrated with the HUB, and indirectly with other segments of the active ring.

B. Cumulative

The primary objective has been to consolidate all the information about a student in one place. Current resources levels rule out this possibility. Until the resource level reaches a point that this is possible, the cumulative ring will be used to meet the cumulative data requirements and still meet our resource constraints. The cumulative ring (with the active and HUB rings) will contain all data for active students.

C. Perpetual

The implementation of the historical ring will bring all the data on inactive students together in one place. By using the historical ring with the other portions of the student records system, a complete history of our student records can be obtained, even though the historical ring may not be part of the technical data base.

D. Flexible

The system design will result in considerable improvement in the systems responsiveness. The consolidation of student data will make it easier to deal with the ad hoc, one-time requests, for

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service. Additionally, the design is not limited to the functional areas shown on Figure 1. Future users could be added to the system using the same concepts presented here. The functional area segments of the active ring are basically independent allowing changes to one function's processing without greatly impacting the other areas. Achieving the required flexibility depends greatly on the software tools available. The following software tools and techniques are the ones being used at UWSP to insure flexibility:

1. State-of-the-art data base technology (DMSII) that will allow the addition or deletion of data elements, data sets and access sets with relative ease.
2. Use of a data element dictionary allowing the characteristics of data elements to be changed independent of the programs using the elements (the data dictionary we use is based on concepts originally developed by Amherst College).
3. The use of structured design and programming techniques to implement software.
4. Integration of all data base updating into a single process. The integration of the active and the cumulative rings makes the update process very complex from a technical viewpoint, but preserves the simplicity from a functional viewpoint. As resources become available and the cumulative ring disappears the updating will be technically simpler, and therefore should be faster, reducing the resource requirements for the update process.
5. Use of generalized reporting software (REPORTER) and generalized terminal screen definition.
6. Use of independent data base load modules allowing the access of portions of the data base based on needs and resource levels.

VI. Implementation of the System

The Proposal for a Comprehensive Student Records System details the original implementation plan of the system. The implementation is divided into three phases. Phase 1 is to implement the HUB ring for maintenance and retrieval. Phase 2 is to implement the active, cumulative and perpetual rings for updating. Phase 3 is to complete the implementation for all report programs. Phase 1 was installed in July, 1980. We are now developing Phase 2 of the implementation.

A. Phase 1

At the same time the first phase of the implementation was begun, another project to implement a new student accounts receivable system was also being developed. We took advantage of an opportunity to combine the two projects. The Housing and Food Service systems were included in the project due to the need for integrating these two systems with Accounts Receivable. For Phase 1 the HUB is maintained from the files comprising the active ring, maintenance directed to the HUB, and systems presently external to the new system (Registration and Records, and Financial Aids).

1. HUB Ring

A technical schematic of the data base is shown in Figure 2 with the primary data relations shown. The six data sets in the center constitute the HUB data base. The HUB contains two catagories of data, the Students HUB, and the Data Element Dictionary. The HUB is always up and available for on-line or batch inquiry or reporting.

a. Students HUB

The three data sets on the left of the schematic constitute the students HUB. The student index is an index of all students that have attended UWSP since 1971 (the beginning point of the old student records system). Each record in the index shows whether the student is active (on the HUB), or inactive (in the historical ring). The students HUB data set contains demographic, biographic, summary, and status information about all active students. The addresses data set is used to deal with multiple, temporary, or special addresses for students.

b. Data Element Dictionary

The three data sets on the right of the schematic constitute the data element dictionary (a derivation of the CASCADE System from Amherst College). The center data set of the data element dictionary, data elements, contains one record for each data element in the system. Each record contains the technical definition of a data element and provides the capability for reporting, editing, or changing data elements without explicitly referring to each by name in a program. The top data set, element values, is used to edit changes (in some cases the value of an element must be valid, major code is an example), or to decode values for reporting. The bottom data set, tables, is used to store the various processing tables such as the enrollment fee table. The content of each table is defined in the data element data set.

2. Active

The data sets outside the HUB data base comprise the active data base. The active data base is located on a removable disk pack and replaces the academic disk pack at 10 p.m. each night for processing. Three functional areas of the active ring have been implemented in Phase 1; Housing, Food Service and Accounts Receivable.

a. Housing and Food Service

The Housing and Food Service segments of the active ring have been combined into a single data set because, typically, a student is either active for both functional areas or neither. Each record contains data for a student active for either Housing, or Food Service related to a specific term (a student can have multiple records, one per term). When the term is completed the data for that term is no longer active for Housing or Food Service.

b. Accounts Receivable

The Accounts Receivable segment of the active ring contains a number of data sets unique to the Accounts Receivable function. The Accounts Receivable function uses four data sets. The billing master data set contains a summary and control record for each students account. A student remains active for Accounts Receivable until he has a zero balance, and no current or future term activity. The activity data set contains a record of all transactions impacting a students account. This provides the audit trail for the system. The charge items data set records each students charges, payments, and waivers by specific charge, e.g. Room, Board, Academic Fees. The charge types data set summarize the status of each university charge that any students may have. For example, one record would show the overall status for room charges, and another for board. This data set provides the link to the University Financial System which is not a part of the student system.

3. Updating Design

Figure 3 is a schematic of the Phase 1 updating system. A feeder program builds a transaction file which is fed to the update control program. The update control program passes each transaction to the proper update module which makes the appropriate update. In certain cases the update made by one module will require a subsequent update to another module (If a student changes his housing plan, his housing charge will need to be adjusted in the Accounts Receivable system). To do this the original module generates one or more transactions that are returned to the update controller for routing to the proper update module. For Phase 1, the update controller and each module have been combined into one COBOL program. We are currently testing the process of having independent update programs, with an ALGOL update controller. This will provide for the addition of independent update modules at a later date, and for integrating the update controller with on-line update programs. This process is consistent with expected advances in the state-of-the-art technology being that programs can be on different computers and when required data base modules are not present, transactions can be stored until the data base module is loaded.

B. Phase 2

The next phase of the project is to add the Admissions, and Registration subsystems to the active ring, and to implement the cumulative and historical rings. In Phase 1, Registration and Records data is transferred to the HUB from the old system. In Phase 2, data will be maintained on the new system and transferred to the old system for reporting. Figure 4 is a schematic of the data sets associated with the HUB and active ring of Phase 2. The cumulative ring schematic is shown separately due to space limitations.

1. HUB

One data set, status pending, has been added to the HUB. This data set will be used for status and control records, and for temporary storage of transactions when the required data base module is not present. The remaining data sets in the HUB will undergo minor changes in data element content.

2. Active

Three functional areas, Admissions, Graduate Admissions, and Registration and Records have been added to the active ring. Accounts Receivable, Housing, and Food Service will remain substantially the same although we will make modifications to take advantage of the increased integration between the subsystems (e.g. immediate fee adjustments for enrollment changes).

a. Admissions and Graduate Admissions

Admissions, and Graduate Admissions are very similar processes. Each will contain a record for students applying for admission (graduate admissions to the Graduate School, undergraduate admission for the remainder). Students will be active for the appropriate admission function until the term of admission has passed.

b. Registration and Records

The Registration and Records function contains six data sets that will be used for its processing (not counting the HUB). They are roughly classified into two catagories of data, student data, and curriculum data.

(1). Student Data

The student term data set contains term oriented data for registered students (credit load, grade point ratio, etc.). The other data set, student classes, provides the bridge between student data and curricular data. This data set records each students enrollment and later his grades.

(2). Curricular Data

At the top of the curricular hierarchy is the course catalog. This data set contains one record for each course offered since 1971 and is conceptually similar to the University Catalog. This data set contains the courses description, prerequisites, and other stable curricular data. The course catalog is perpetual in nature.

The sections data set is similar to the course timetable. Students would enroll in sections and a student class record would be added relating that students term record with the appropriate section record. The sections data set is term oriented.

The meeting data set contains time, place, and instructor information about a particular section, or sections. This data set is needed to deal with multiple instructors, meeting places, lecture lab situations.

The relations data set associates the section records with the meeting records. This data set is required to deal with multiple meetings for a given section, (lecture, lab), and/or multiple sections for a meeting (cross listings, shared lectures), or a combination of the above.

The Registration and Records portion of the active ring is basically term oriented. When grades are finalized for a particular term all records associated with that term become inactive. At that time, another term would normally be in session. We anticipate requiring five active terms in the active ring; three previous terms, the current term, and the next term.

3. Cumulative

Figure 5 is a schematic of the cumulative ring. The cumulative ring is an extension of the active ring, and each data set closely relates to a corresponding one in the active ring. A number of data sets in the active ring do not appear in the cumulative ring because these data sets are perpetual in nature and do not require extension into the cumulative ring.

4. Historical

The historical ring is not included in any of the schematics. The historical ring will consist of a single multivolume, multiformat type file. Its primary purpose will be to feed our MIS facility with extract files and the nonhistorical position of the system with machine readability data on students being reactivated.

5. Active, Cumulative, and Historical Coordination

A key ingredient to this structure is the definition of where particular records will be kept in the various rings. If a student is active for one or more functional areas, the active data for active functional areas will be kept within the active ring, and inactive data for all functional areas will be in the cumulative ring. If a student is inactive for all functional areas, all records for that student (except the index record) will be removed from the HUB, active, and cumulative rings and placed into the historical ring. If an inactive student is reactivated, then all records will be removed from the historical ring, and will be placed in the appropriate ring (HUB, Active, or Cumulative).

C. Phase 3

Phase 3 will complete the implementation of all report programs on the new system. Until the completion of Phase 3, most reporting will be done off the old system. Each day the old system will be updated from the new allowing reporting without requiring the conversion of all report programs during Phase 2.

After Phase 3, we plan to implement several new applications that were not feasable before (e.g. degree audit, and computerized transcript production).

VII. Conclusion

The system described here approaches the ideal system in the UWSP environment to the extent our resources enable us. In another environment this system may not work effectively, but our model should provide a useful starting point. The process we used to develop the ideal, we feel, would be applicable in any environment. The following list summarizes these steps.

A. Define the characteristics of an ideal system. In our case we did not concentrate on applications, an ideal system should be able to support any legitimate application.

B. Examine the alternatives. In many cases adequate software can be acquired cheaper than it could be built. Proceed only when convinced there isn't one.

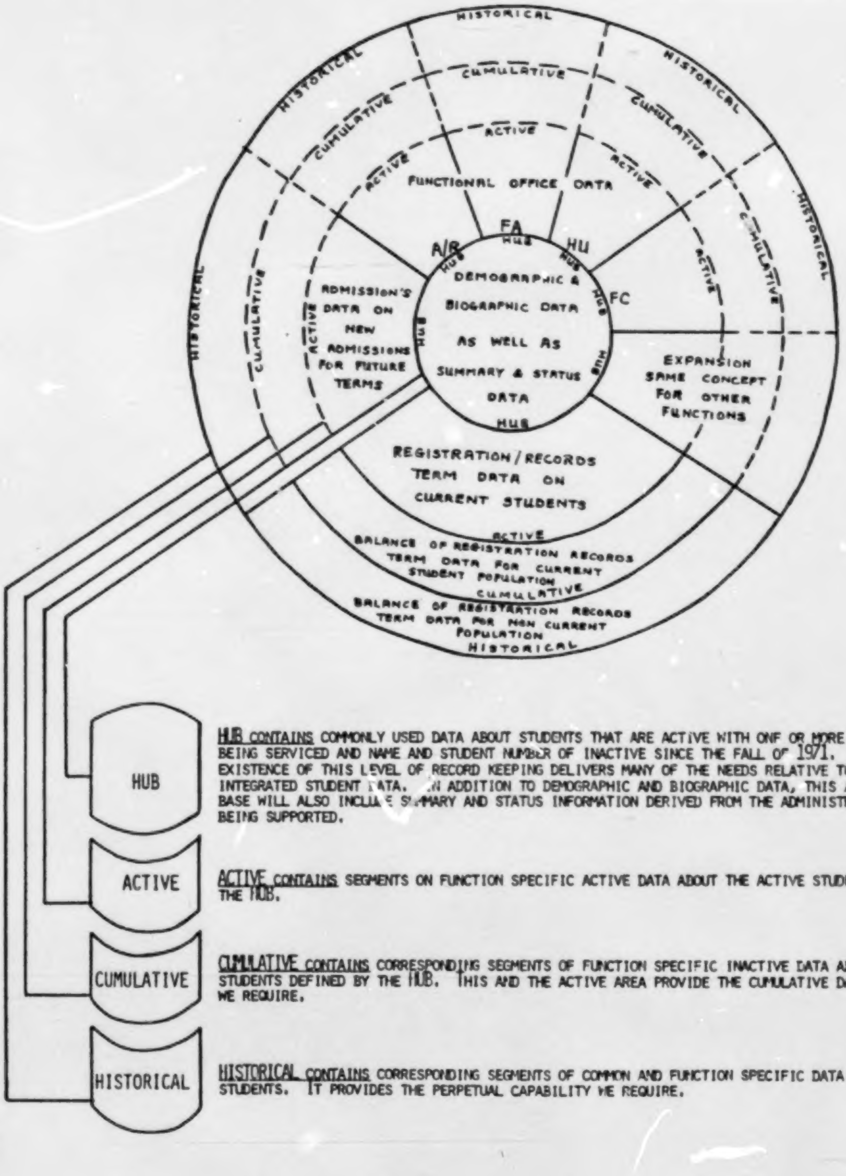
C. Apply resource constraints to the ideal yielding a conceptual design. The conceptual design when evaluated against the ideal should come close to the ideal as resources increase.

D. Plan the implementation. In our situation it was relatively easy to plan a phased implementation. The HUB, and the functional area pies are independent enough to allow the project to be broken into manageable tasks.

E. Implement the system. During the implementation, the ideal, and the conceptual design must be continually used to validate the detail design. Often we have been tempted to violate the concepts of the ideal for immediate savings. These violations could save time in the short term but could cost more in the long term.

FIGURE 1

IMPROVED STUDENT RECORDS SYSTEM - OVERVIEW OF DESIGN


HISTORICAL
CUMULATIVE
ACTIVE
FUNCTIONAL OFFICE DATA
FA
A/R
HU
FC
HUB
DEMOGRAPHIC & BIOGRAPHIC DATA AS WELL AS SUMMARY & STATUS DATA
ADMISSION'S DATA ON NEW ADMISSIONS FOR FUTURE TERMS
EXPANSION SAME CONCEPT FOR OTHER FUNCTIONS
REGISTRATION/RECORDS TERM DATA ON CURRENT STUDENTS
BALANCE OF REGISTRATION RECORDS TERM DATA FOR CURRENT STUDENT POPULATION
BALANCE OF REGISTRATION RECORDS TERM DATA FOR NON CURRENT POPULATION
HUB
ACTIVE
CUMULATIVE
HISTORICAL

HUB CONTAINS COMMONLY USED DATA ABOUT STUDENTS THAT ARE ACTIVE WITH ONE OR MORE OF THE FUNCTIONS BEING SERVICED AND NAME AND STUDENT NUMBER OF INACTIVE SINCE THE FALL OF 1971. THE VERY EXISTENCE OF THIS LEVEL OF RECORD KEEPING DELIVERS MANY OF THE NEEDS RELATIVE TO THE NEED FOR INTEGRATED STUDENT DATA. IN ADDITION TO DEMOGRAPHIC AND BIOGRAPHIC DATA, THIS AREA OF THE DATA BASE WILL ALSO INCLUDE SUMMARY AND STATUS INFORMATION DERIVED FROM THE ADMINISTRATIVE SUBSYSTEMS BEING SUPPORTED.

ACTIVE CONTAINS SEGMENTS ON FUNCTION SPECIFIC ACTIVE DATA ABOUT THE ACTIVE STUDENTS DEFINED BY THE HUB.

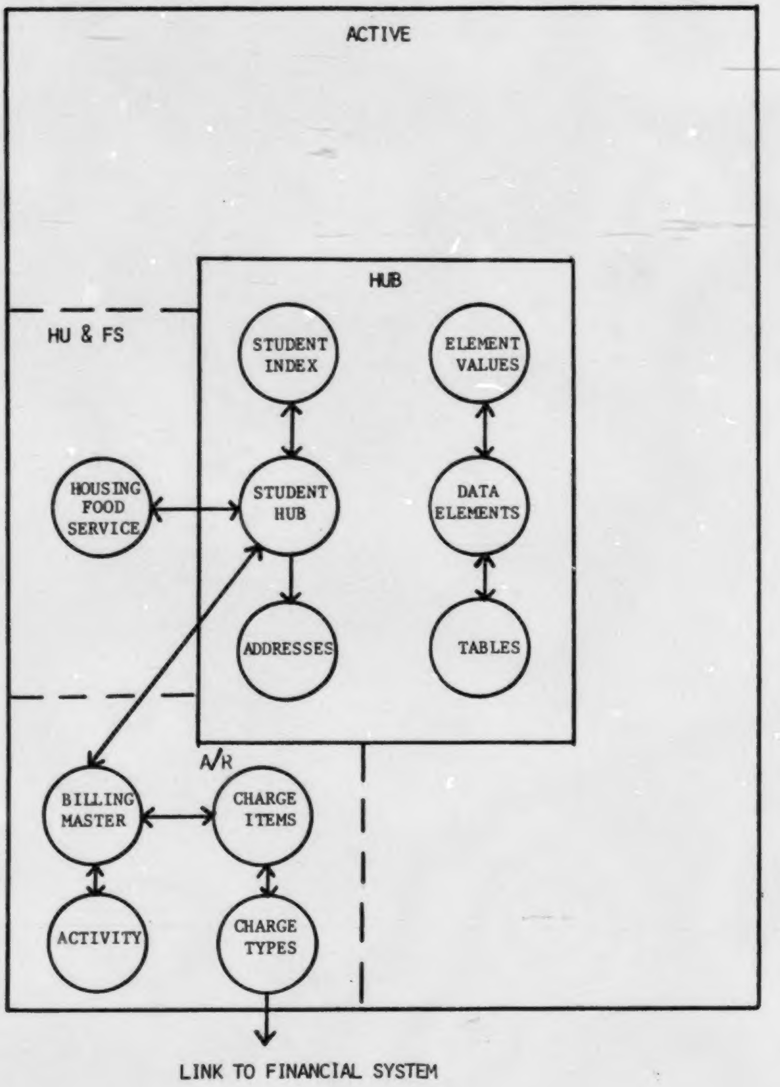
CUMULATIVE CONTAINS CORRESPONDING SEGMENTS OF FUNCTION SPECIFIC INACTIVE DATA ABOUT THE ACTIVE STUDENTS DEFINED BY THE HUB. THIS AND THE ACTIVE AREA PROVIDE THE CUMULATIVE DATA CAPABILITY WE REQUIRE.

HISTORICAL CONTAINS CORRESPONDING SEGMENTS OF COMMON AND FUNCTION SPECIFIC DATA TO INCLUDE INACTIVE STUDENTS. IT PROVIDES THE PERPETUAL CAPABILITY WE REQUIRE.

OCS 11/24/80

FIGURE 2

PHASE 1 IMPLEMENTATION
DATA SET RELATIONS


ACTIVE
HUB
HU & FS
STUDENT INDEX
ELEMENT VALUES
HOUSING FOOD SERVICE
STUDENT HUB
DATA ELEMENTS
ADDRESSES
TABLES
A/R
BILLING MASTER
CHARGE ITEMS
ACTIVITY
CHARGE TYPES

LINK TO FINANCIAL SYSTEM

FIGURE 3

PHASE 1 IMPLEMENTATION
UPDATE DESIGN

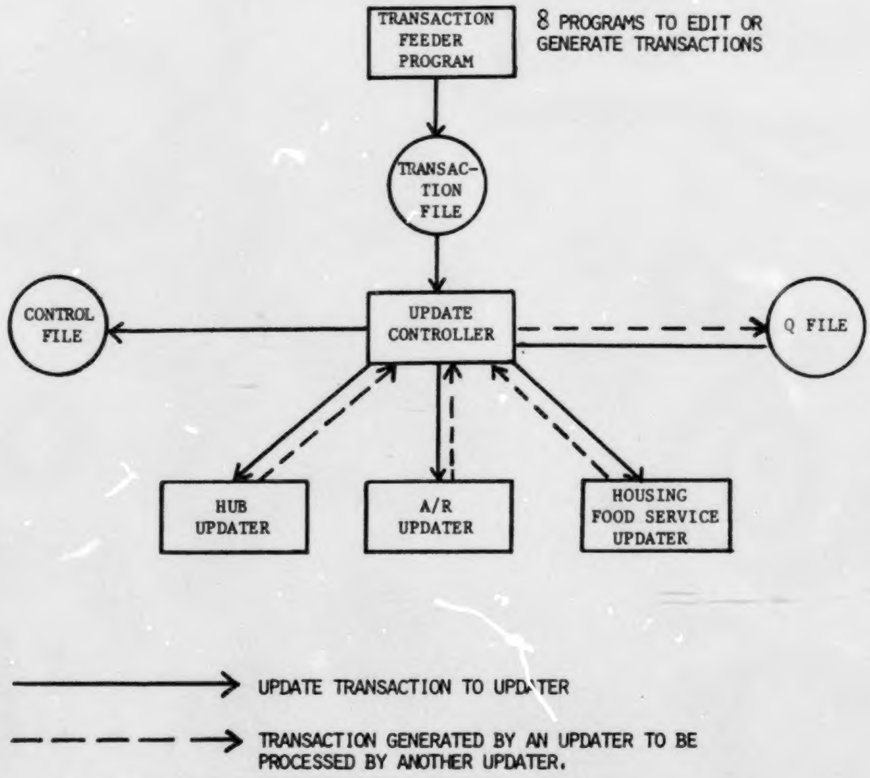

TRANSACTION FEEDER PROGRAM
8 PROGRAMS TO EDIT OR GENERATE TRANSACTIONS
TRANSAC-TION FILE
CONTROL FILE
UPDATE CONTROLLER
Q FILE
HUB UPDATER
A/R UPDATER
HOUSING FOOD SERVICE UPDATER
UPDATE TRANSACTION TO UPDATER
TRANSACTION GENERATED BY AN UPDATER TO BE PROCESSED BY ANOTHER UPDATER.

FIGURE 4

PHASE 2 PLANNED IMPLEMENTATION
ACTIVE DATA BASE

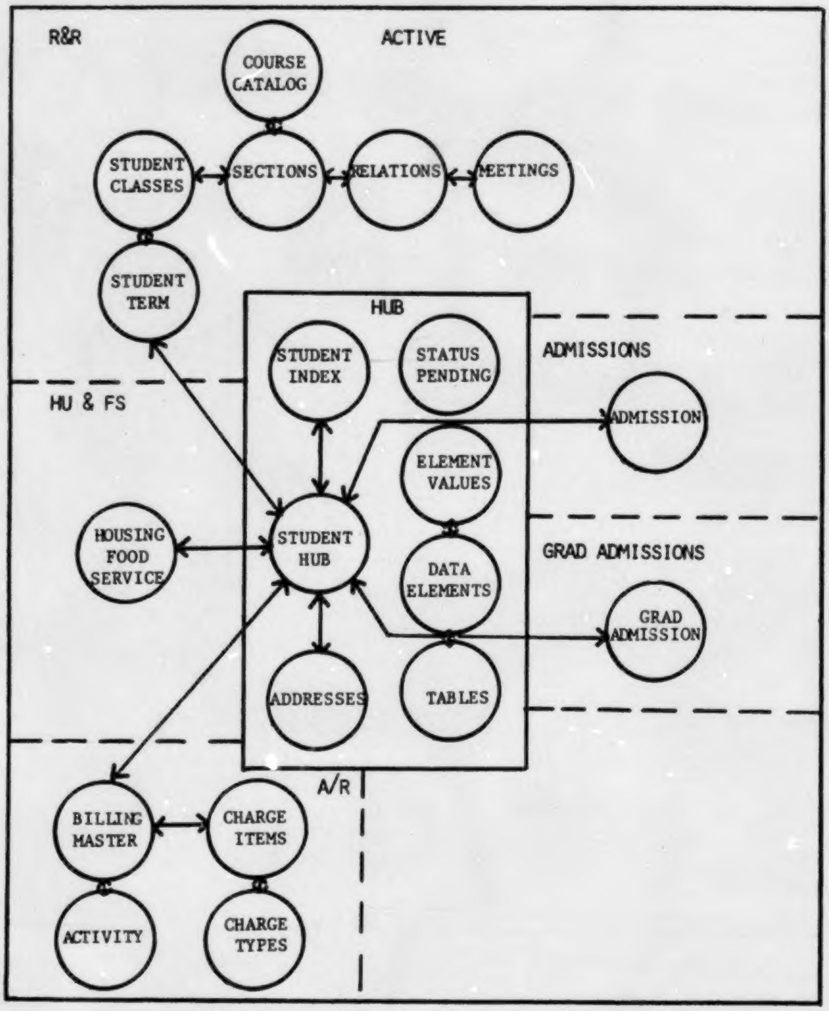
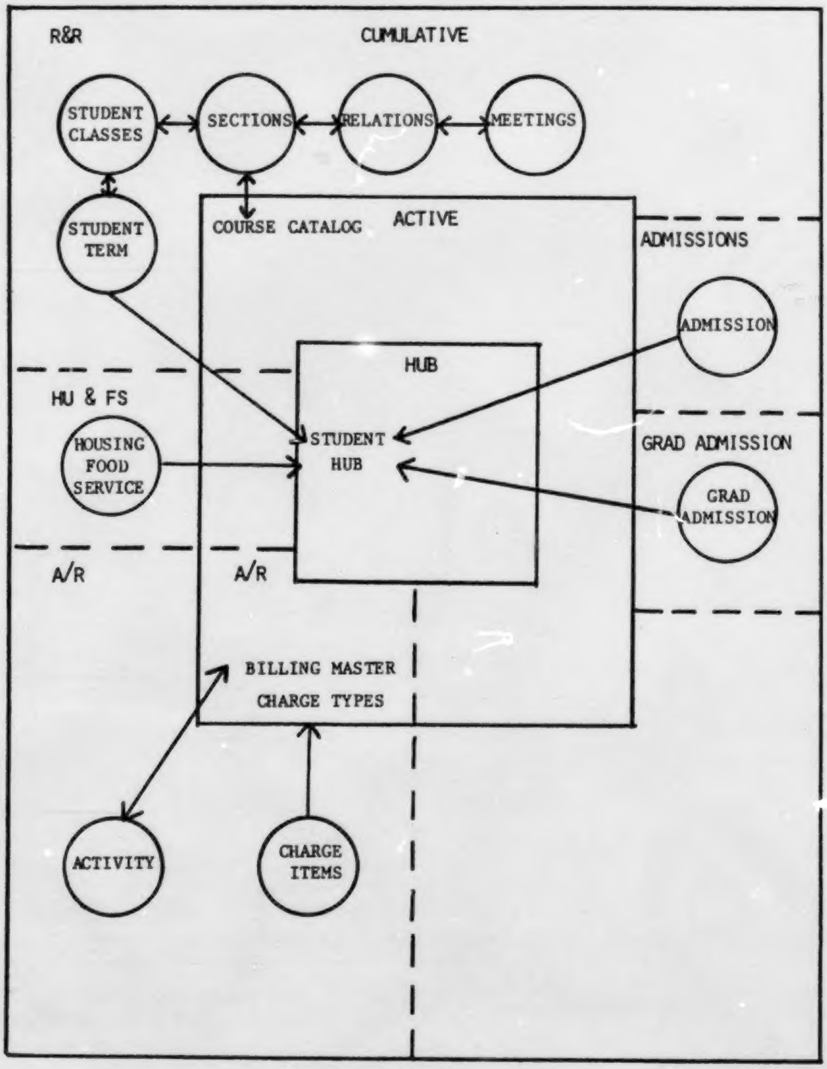

R&R
ACTIVE
COURSE CATALOG
STUDENT CLASSES
SECTIONS
RELATIONS
MEETINGS
STUDENT TERM
HUB
STUDENT INDEX
STATUS PENDING
ADMISSIONS
HU & FS
ADMISSION
ELEMENT VALUES
HOUSING FOOD SERVICE
STUDENT HUB
DATA ELEMENTS
GRAD ADMISSIONS
GRAD ADMISSION
ADDRESSES
TABLES
A/R
BILLING MASTER
CHARGE ITEMS
ACTIVITY
CHARGE TYPES

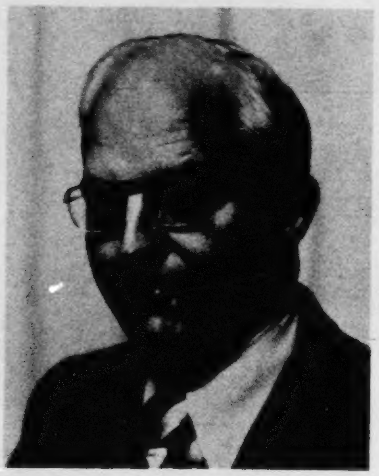
FIGURE 5

PHASE 2 PLANNED IMPLEMENTATION
CUMULATIVE DATA BASE


R&R
CUMULATIVE
STUDENT CLASSES
SECTIONS
RELATIONS
MEETINGS
STUDENT TERM
COURSE CATALOG
ACTIVE
ADMISSIONS
ADMISSION
HUB
HU & FS
HOUSING FOOD SERVICE
STUDENT HUB
GRAD ADMISSION
GRAD ADMISSION
A/R
A/R
BILLING MASTER
CHARGE TYPES
ACTIVITY
CHARGE ITEMS

TRACK VI
VENDOR PRESENTATIONS

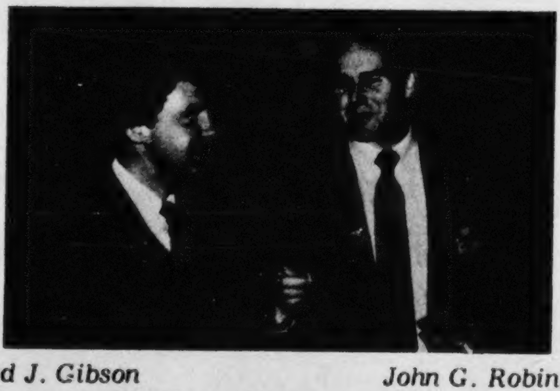
Coordinator:
Maurice P. Arth
Cuyahoga Community College, Ohio



Robert S. Briggs
Pansophic Systems Inc.

Marjorie L. Kimbrough
Management Science America

Daniel V. Callahan
Integral Systems, Inc.



Donald J. Gibson
Westinghouse DataScore Systems

John G. Robinson
Information Associates

PARTICIPATING COMPANIES

Participation of the following companies in the 1980 CAUSE National Conference was greatly appreciated:

Arthur D. Little Systems, Inc. (ADLS)

IBM Corporation

Informatics, Inc.

Information Associates (IA)

Integral Systems, Inc. (ISI)

Management Science America, Inc. (MSA)

National Computer Systems, Inc. (NCS)

National Software Enterprises, Inc.

Pansophic Systems, Inc.

Sperry/Univac

Systems and Computer Technology Corporation (SCT)

A special thanks to Sperry/Univac for contributing the Speakers Guidelines Brochure for the CAUSE 80 presentors.

Arthur D Little Systems, Inc. 10 NEW ENGLAND EXECUTIVE PARK • BURLINGTON, MA 01803 • (617) 272-3400

THE STUDENT RECORDS SYSTEM: ITS FUNCTIONS AND ARCHITECTURE

The MBRCC Student Records System was developed by Arthur D. Little Systems through a unique collaborative approach, a Software Cooperative, established by the Massachusetts Board of Regional Community Colleges (MBRCC) on behalf of the fifteen Massachusetts community colleges. The system objective of the MBRCC Student Records System is to provide an analytic tool to support planning, management, and accountability of the Massachusetts community college academic programs (both day and evening programs) including the functions of Admissions, Financial Aid, Registration, and Registrar's processing. The Student Records System is a state-of-the-art application employing the latest tools available in minicomputer technologies, including: on-line, real time and batch access to the data base; data base access methods; transaction-based processing, interfaces for communications protocols through distributive processing; and word processing. The MBRCC Student Records System has been developed to take advantage of the architecture of the Data General ECLIPSE series equipment. At CAUSE 80 ADLS presented an executive summary of the functions and architecture of the Student Records System.

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ANSWER/DB

Answer/DB is an on-line, user-oriented reporting system designed to enhance programmer productivity by relieving data processing staff of the report generation task.

This new software product enables users to enter their own English Language report statements at a teleprocessing terminal and to access DL/1 data bases and other files without knowing the structure of the data. Report requests are prepared interactively with extensive diagnostics to assist the requestor. Both on-line and batch data bases and files can be accessed.

The concept of Answer/DB and an illustration of the simplicity of using the system were presented at CAUSE 80.

information associates, inc.
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SUMMARY OF PRESENTATION AT CAUSE - 80
Concurrent Session 4

John G. Robinson, Information Associates, Rochester, New York:

Information Associates announced its recent acquisition by Westinghouse DataScore Systems, a division of Westinghouse Learning Corporation. IA is proud that CAUSE was the forum for this announcement, because we have actively supported CAUSE since 1973 and been a sustaining member since 1976.

The 12 year history of Information Associates was briefly surveyed, highlighting the development of a full line of program products for college and universities for student, financial, and personnel administration; the growth of active user groups now attracting more than 600 national and international attendees; and the evolution of product release and quality assurance programs to improve productivity of IA and customer personnel.

During this time, IA products and services have been provided to more than 200 institutions, many of which have purchased several systems. More than a half million students are served by IA student systems, and at least one dollar of every eleven spent in higher education in the U.S. is managed and controlled by the IA Financial Accounting System.

The desire to continue on the course set during the past 12 years and the desire to move even more rapidly to meet the pressing needs of Higher Education administration, have led IA to Westinghouse.

Donald J. Gibson, Westinghouse DataScore Systems, Iowa City, Iowa:

Westinghouse DataScore Systems is a division of Westinghouse Learning Corporation and is in the business of providing products and services for the collection, processing, and reporting of data. With a 27 year history of association with and service to education, DataScore is one of the largest processors of standardized tests in the world. In addition to scoring and reporting for more than 100 million test documents per year, DataScore offers a full range of Educational Data Services, including scheduling, attendance, grades, and accounting to schools and school districts nationwide

DataScore is a pioneer and technology leader in the field of optical scanning for data collection applications and offers a full range of services related to this technology. In adddition to the recently announced W201 scanner system, specialized printing services and complete data systems support are offered for applications as diverse as national census, test scoring, personnel and student records, and inventory systems.

Westinghouse Electric Corporation has a long history of commitment to higher education. Grants and matching gifts to colleges and universities, tuition aid to students, and the Westinghouse Science Talent Search were cited as examples of this commitment.

In addition, Westinghouse is a leader in our society in programs of productivity improvement, and within Westinghouse, DataScore has been a leader in employing advanced techologies and management methodologies to improve of productivity. These techniques, as well as the technological, financial, and people resouces of Westinghouse, will be applied to continue and to enhance, products and services of Information Associates.

John Robinson:

With the new organization of Information Associates and DataScore, and with the resources of Westinghouse, we plan major investments in products and services to benefit educational institutions. The product release and quality assurance methodologies of IA will be enhanced and accelerated to provide Reliable Software which can be implemented smoothly and efficiently.

We will also intensify efforts to meet the needs of higher education with six programs:

1. Full Product Line
2. Enhanced Products
3. New Products
4. Management tools
5. Delivery Methods
6. Full Support

By investment in these programs, we intend to be of greatest possible service to our customers. The productivity of our new organization and the highest quality products and services to enhance the productivity of colleges and universities will continue to be our greatest commitment.

For information please contact:

Richard B. Bagby
Information Associates
a Service of Westinghouse Learning Corporation
97 Humboldt Street
Rochester, New York 14609
(716) 288-6900

information associates, inc.
97 Humboldt St., Rochester, NY 14609 • 716 288-6900 • TELEX 978389

INFORMATION ASSOCIATES/WASHINGTON STATE UNIVERSITY

VENDOR TRACK PRESENTATION

Monday, December 8, 2:30 a.m.

CAUSE '80

Jim Lyon of Information Associates, a Service of Westinghouse Learning Corporation, briefly described the company and its proven line of administrative software for higher education and gave an historical perspective relative to the Financial Aid Management System (FAMS). This sophisticated on-line product was initially developed at Indiana University and has subsequently been installed at ten additional colleges and universities representing both private and public, large and small, 2-year and 4-year, and single and multi-campus institutions.

A discussion of where FAMS fits in the spectrum of administrative computing revealed that it is a significant module of both a Student Information System and a Financial Management System. However, the design of FAMS facilitates the required division of labor between student service personnel and business office personnel, thus establishing a prudent internal control mechanism.

Jim concluded his remarks with the statement that FAMS is just "FAMSTASTIC".

Lola Finch, Director of Financial Aid at Washington State University and a user of FAMS, agreed that FAMS is "FAMSTASTIC". She then described in detail the implementation process at WSU and emphasized the need for commitment from and communication between the data processing department and the financial aid office. Lola stressed the fine working relationship which exists at WSU and which developed between the University and Information Associates. Of equal importance is the realization that FAMS is just a tool albeit comprehensive and sophisticated, and that the user must use this tool effectively to achieve the desired results.

At WSU, FAMS was installed on an AMDAHL computer under CICS and ADABAS. The FAMS inplementation was accomplished in about one year including the conversion to ADABAS which was a time comsuming task. WSU also purchased the Billing/Receivables System (BRS) and the Student Loan System (SLS) from Information Associates. These systems are also being installed under ADABAS and will nicely complement FAMS.

In the response to questions, Lola explained WSU's vendor selection process and stated that their FAMS expectations had been met by Information Associates. Jack Steingraber, Director of Computing Services at WSU, answered numerous data processing questions regarding the project and the ADABAS conversion.

integral systems, inc.

39 quail court • walnut creek, california 94596 • (415) 938-7600

PROPRIETARY SOFTWARE IS THE ANSWER

For years, it was not at all uncommon for a data processing manager in a college or university to initiate the need for a new application system, design the system, and monitor the overall level of acceptance of the system. Times have changed--no longer are such decisions made by only one department.

The skyrocketing cost of internally developed systems has lead to the current practice of completing extensive cost/benefit analyses before any project is started. Data processing managers in both colleges and universities are finding themselves accountable to a steering committee comprised of financial analysts, internal auditors and managers from a number of functional areas. It is no longer sufficient to develop a brief report on why a new system should be developed. Steering committees are requiring extensive cost/benefit analyses to normalize all project costs and, at a minimum, the calculation of the discounted present value of each new system that is proposed.

This is posing an interesting problem for many programmers and system analysts that are now advancing into data processing management. Suddenly they are asking themselves why their decisions and performance are being monitored so closely. The answer seems to rest in the fact that throughout the 1970s many data processing staffs at colleges and universities:

--embarked on system design/development projects of relatively low priority from a cost/benefit standpoint;

--experienced significant delays in having new systems operational; in some cases, man-years were necessary to install a new system rather than the scheduled man-months;

--failed to properly account for all project costs thereby leaving an unknown attached to every new system that was proposed;

--developed systems that were on many occasions inconsistent with the needs of management;

eastern office 8 main street • flemington, new jersey 08822

--installed systems that were insufficiently documented from both a technical and user's perspective;

--developed systems that were not truly state-of-the-art thereby causing an unnecessary amount of follow-on system maintenance; and

--in general, became subject to the ever present problems of reduced data processing budgets and a high rate of turnover among their employees.

To resolve these types of problems, there has been a phenomenal growth in the acquisition of proprietary software by colleges and universities throughout the United States. All indications are that by 1985, well over 95% of the institutions of higher education will have acquired proprietary software to reduce their operating costs and measurably increase the productivity of their professional employees.

Since 1972, Integral Systems, Inc. (ISI) has taken a commanding position with respect to software tailored toward the unique demands of colleges and universities. An example of this fact, is that ISI has installed more Payroll/Personnel Systems in Higher Education than all other software vendors in the United States and Canada.

To learn more about why you should explore the benefits of proprietary software, please plan on attending ISI's presentation. A special discussion will take place on how one large university completed a detailed cost/benefit analysis and determined that by acquiring ISI's software they would dramatically reduce their installation timetable and at the same time realize substantial cost savings when compared to an internally developed system. Additionally, a special review will be made of how proprietary software should be evaluated from the perspective of the data processing manager.

If additional information is required, please feel free to contact:

Mr. Michael Hastings
Vice President,
Western Regional Sales
Integral Systems, Inc.
39 Quail Court
Walnut Creek, CA 94596
(415) 938-7600

or

Mr. Robert Bartman
Vice President,
Eastern Regional Sales
Integral Systems, Inc.
2 Main Street
Flemington, NY 08822
(201) 782-3600

International Business Machines Corporation

10401 Fernwood Road
Bethesda, Maryland 20034
301/897-2000

IBM allotted it's time on the CAUSE '80 agenda to provide the State University System of Florida the opportunity to demonstrate its UNIFTRAN registration system. Their system is an on-line distributive processing system that utilizes the IBM 8100 Information System.

The IBM 8100 System used at CAUSE '80 operated in stand-alone mode. The configuration consisted of an 8140-B51 processor with 512K of memory and 58MB of fixed disk; an 8101-A13 storage and Input/Output Unit with 64MB of fixed disk; an 8809 Tape Magnetic Tape Unit; and two 8775 Display Terminals.

The UNIFTRAN system was demonstrated by Joe McGuire, Jim Thompson, and Frank Ellzey of the Florida State University System. They showed how the 8100 has streamlined the registration process at their institutions.

The demonstration began with an on-line definition of the registration process via an 8775 Display. This included definition of what functions were required and security levels. They then went through the actual registration process, including drop/add, checking section status, and printing bills.

The UNIFTRAN system illustrates only one use of the 8100 Information System. Additional information may be obtained through your local IBM marketing representative or:

Judith A. Nicholson
Education Industry
IBM Corporation
Data Processing Division
10401 Fernwood Road
Bethesda, MD 20034
(301/897-2039)

MSA
THE FINANCIAL SOFTWARE COMPANY

AUTOMATING HUMAN RESOURCE MANAGEMENT SYSTEMS

The proliferation of government rules and regulations and the resulting reporting requirements make the automation of human resource management imperative. A flexible information system not only yields timely reporting capabilities, but also makes it possible for personnel administrators to move beyond the information processing business onto generating solid information for management decisions. This presentation addressed the following areas:

- o Personal Information
- o Job/Review Data
- o Education, Training Skills
- o EEO, Workforce Utilization and Reporting Requirements
- o Salary, Performance Reviews and Comparable Worth
- o Leave and Termination Data
- o Life-to-Date History
- o Benefits/ERISA Administration
- o Position Control/Wage and Salary Administration
- o Applicant Flow
- o Lost Time/Health and Safety (OSHA)
- o Employee/Labor Relations
- o Career Development/Career Paths

For further information regarding the automated software systems which Management Science America markets contact:

Mrs. Marjorie L. Kimbrough
Human Resource Industry Specialist

MANAGEMENT SCIENCE AMERICA, INC./3445 PEACHTREE RD., N.E./ATLANTA, GEORGIA 30326/(404) 262-2376

NATIONAL COMPUTER SYSTEMS

4401 W. 76TH ST. MINNEAPOLIS, MINN. 55435 PHONE 612/830-7600

DOCUMENT PROCESSING SYSTEM

The use of a proprietary software package developed by National Computer Systems, Inc. (NCS) to run on the Sentry 80 Optical Mark Reading System was discussed and demonstrated at CAUSE 80. The system and software are currently installed at Temple University, University of Wisconsin and the University of Minnesota plus other educational users.

The Document Processing System has five main functions.

1. Scanning (OMR)

An identification number, or "Process Number" is assigned to a batch of documents, and a special scannable header sheet with that Process Number is placed with the sheets. The sheets are scanned, header sheet first. During scanning, a serial number is printed on each sheet, along with the batch Process Number. No special edit checking is performed during scanning. Output of the scanning operation is read out to tape, or more frequently is used to build a disk file on-line. Use of NCS' DOSSIER or "Sheet Compile" scanner languages allows users to easily set up parameters for resolving any type of optical mark reading form.

2. On Line Editing

Records of scanned documents are called up for on-line editing. Only those documents which fail the editing parameters are displayed, and normally only a questionable field may be edited. The DPS editor checks each form's record against a list of parameters. Normally, most records meet the parameters and are passed on. But when the DPS Editor finds a record that fails to meet any of the parameters, the questionable section is reproduced on the video display terminal. You can compare the actual document with the display. If there is an error in what the scanner read, you correct it at the terminal. This completely eliminates re-marking and re-scanning the documents.

The DPS Editor also allows for record by record manipulation. It provides the capability to move groups of documents that have gotten out of sequence. You can delete, insert or modify any record.

The parameters used to "drive" the on-line editor are composed by the user. The parameters are entered once for each application via a VDT (CRT) tube. The parameters are entered as English language statements to control the editing. The edit specification language allows the user a powerful but easy to use tool for on-line editing.

3. Production Controller

The Production Controller keeps track of documents or "processes" on their way through the DPS system from scanning through archive. Along with controlling the flow of work, it assigns and keeps track of pathnames for files that are routed to each successive step of the system, and deletes files that are no longer needed. It assigns priorities to each step so that everything flows smoothly.

As the DPS Production Controller activates, terminates, and sends process groups to each of the various steps, it records start and finish times of the various steps. At any time, you can display the current status of a batch. If you want a process to move faster or slower, you can change its priority. You can attach a note to any batch, for example, to warn about possible problems or to give special instructions.

The DPS Production Controller will even permit you to rerun a process if necessary. You can tell the DPS Production Controller how many of the automated or "background" tasks you want running at any one time. That way, you can do the editing during the day and the scoring (a background task) at night.

4. Data Manipulation and Reporting

Data manipulation and reporting can be handled by custom software or by Product Sets developed by NCS. The Product Sets generated by NCS will be application specific such as Test Scoring, Grade Reporting and Sales Call Analysis. The Product Sets or custom software receive clean data from the editor and utilize the Production Controller for control and monitoring.

5. Archive

Archive simply provides a convenient method for saving processed document images on magnetic tape and retrieving them later for subsequent processing.

The Document Processing System maintains the following files: Edit Specification Files, Edit Record Description File, Production Control File, Archive History File, and Batch Transaction Files.

Pansophic Systems, Inc.
709 Enterprise Drive
Oak Brook, Illinois 60521
312 986 6000

ANSOPHIC

PANRISK

With increasing numbers of dollars invested in data processing installations and an increasing range of organizational activities coordinated by computer, the issue of security needs to be addressed thoroughly and systematically. Not only is the costly electronic equipment at risk, but also the revenue gathering and disbursing apparatus located in the computer. Risks of fraud, theft, and loss of customer confidence are potentially as devastating to a typical DP center as are the more dramatic catastrophes of fire, natural disaster, sabotage, and vandalism.

PANRISK helps you perform risk analysis, a deliberate, quantitative process which systematically exposes the vulnerabilities of an EDP center. There are three major steps in risk analysis.

1. Identify Threats

First, risk analysis identifies threats which put at risk those assets controlled by or located in the EDP facility. These threats fall into five general categories: (1) physical damage to the EDP facility; (2) delays in application processing; (3) fraudulent use of organization assets; (4) unauthorized disclosure of computer files; and (5) theft of the facility's physical assets.

2. Quantify Assets

Second, risk analysis calculates the potential dollar losses each of these threats can cause with respect to each of the three principal components or assets of an EDP center: physical equipment, application programs and master files.

3. Formulate Contingency Plans

Finally, risk analysis permits you to formulate one or more contingency plans and assess the value of protective measures designed to reduce potential losses.

Because virtually every organization plans a budget on an annual basis, PANRISK uses the year as its time unit of analysis. For each of the five threat categories, PANRISK calculates an annual loss expectancy (ALE) using the following formula: threat occurrence rate (per year) times single occurrence loss expectancy = ALE ($ per year) where the threat occurrence rate is the number of times a threat is likely to occur per year (it may be fractional), and where the single occurrence loss expectancy is the total number of dollars expected to be lost from a single occurrence of the threat.

PANRISK has the capability of generating five matrices, one for each category of threats operating on one or more elements of the EDP installation (damage threats may result in delay threats, etc.). Each cell in such a matrix contains the annual loss exposure expected from a particular threat's impact on an element of the EDP facility.

PANRISK uses these matrices to generate three kinds of reports for each threat category:

1. Total annual loss expected (ALE) with respect to each threat
2. Total annual loss expected (ALE) with respect to each EDP element
3. Single occurrence threat loss exposure with respect to each threat

In all reports, the losses are listed in decending order of magnitude, thereby calling attention to the most serious threats and the most vulnerable parts of your DP center. The third report type isolates those threats whose single occurrence may pose a catastrophic financial blow to your organization.

Simply put, PANRISK does the tedious work of constructing the matrices and calculating their individual cells to generate reports which provide you with the rational means for developing contingency plans and taking protective measures. All PANRISK asks of you is to provide some simple, straightforward data about threat occurrence rates and a few other parameters and loss potential data for the three different elements of the EDP facility.

SCT SYSTEMS OF THE EIGHTIES

Integrated Student Information System (ISIS)

To provide needed student-related data, SCT designed its on-line Integrated Student Information System (ISIS). ISIS collects, processes, stores, retrieves, and reports demographic, biographic, academic history, and student financial data. It maintains all student information on pre-applicants through continuing and recently-enrolled students. Using a common data base, it facilitates record modifications and optimizes reporting capabilities to insure convenient, accurate services to students and administrators, reduces clerical work, and provides more timely, efficient processing of student information.

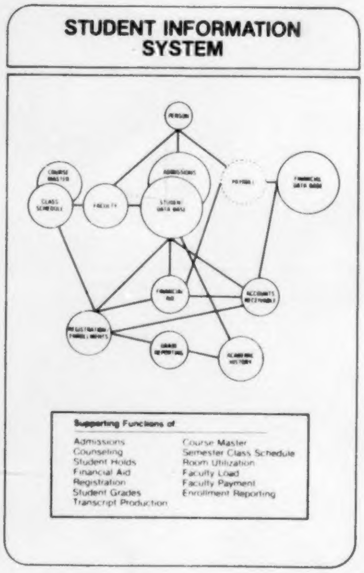
System modules are completely compatible in order to provide the proper integration between student system components and related accounting system components. Together, they work to establish a base of data. The system is designed for maximum data security to prevent illegal or unauthorized access. It also maintains data within a set of user-defined parameters and provides for the archiving of data. All transactions are retained for audit and recovery purposes.

The unique SCT information system further provides an audit trail for verification of changes, as well as back-up files for recreation or recovery in case of loss of files being processed.

As a fully integrated on-line system, it provides a single source of data, allows maximum access while optimizing updating capabilities, and organizes modules (terminal screens) by adminstrative functions.

ISIS meets the functional requirements of each client institution through a series of modular subsystems, each relating to specific administrative needs. As a result, this sophisticated computing resource can act as the official source of student information for use by most administrative services offices, including:

- Admissions, Registration, and Records;
- Advisors and Counselors;
- Accounting and Business Offices;
- Deans, Department/Division Heads and Faculty;
- Financial Aid and Veterans Offices;
- Educational Planning and Research.


STUDENT INFORMATION SYSTEM

Supporting Functions of

Admissions
Counseling
Student Holds
Financial Aid
Registration
Student Grades
Transcript Production
Course Master
Semester Class Schedule
Room Utilization
Faculty Load
Faculty Payment
Enrollment Reporting

Human Resources Information System

The Human Resources Information System is made up of three subsystems which comprehensively address the management and administration of personnel and the personnel services budget for the institution. The three functional interrelating components, consisting of position/budgeting control, personnel, and payroll, provide automated support that can expedite all information processing and reduce errors in repetitive clerical tasks associated with these key functions. All components are integrated and on-line, supporting immediate data entry and information retrieval and provide consistency of data by utilizing a single data base for the storage of all employee information.

Payroll

The Payroll subsystem provides information processing capabilities in the areas of time collection/balancing, check creation, and reconciliation, payroll adjustment, and labor distribution, among others.

Concurrently, exception and/or positive time reporting by individual position/employee class is supported. Capabilities also include the ability to process variable contract lengths—e.g., work ten months, pay twelve months. The subsystem accommodates one-time payments, special rates per course or contact hour, overloads, retirement payoff, etc. Each unique payment may be taxed utilizing separate taxation criteria and automating the calculation of gross pay, deductions, taxes and net pay.

Time Recording and Payroll Adjustment processes are on-line. Further, "Pay Events" (checks and adjustments, for example) are maintained on-line for a client-specified period to facilitate reference in the event of inquiry. Extensive payroll reporting is provided, including: time sheet proof, payroll calculation exceptions, checks, direct deposit notices, check register, payroll register, benefit/deduction register, benefit/deduction enrollment reports, W-2 and tax reports, and labor distribution reporting.

Position Budgeting/Control

The Position Budgeting/Control subsystem provides the institution with an on-line capability for the creation and maintenance of the personnel services budget. It automatically updates expenditure data against budgeted positions and the resultant status and balances are immediately available on-line. Extensive reporting capabilities, including the ability to generate authorized position rosters to assist in the recruiting process and expenditure reports which highlight non-budgeted and over-budgeted expenditures, are a part of the system.

Personnel

The Personnel subsystem provides the institution with on-line support for personnel functions and a method for data collection and maintenance for personnel actions, including applicant processing, hire/rehire, assignment/appointment, leave of absence, sabbatical, and termination.

This subsystem features comprehensive reporting capabilities, including the ability to generate traditional personnel reports, such as Pending Action Lists, Pending Employee Reviews, Bargaining Unit Census, Employee Leave Accounting, Benefit/Enrollment, Maintenance Activity reporting and Telephone Directory. More recently, required reports such as EEO, Affirmative Action, and Benefit Profiles, are also produced.

Budget Preparation System

The Budget Preparation System is an on-line interactive system designed to increase the efficiency of the budget development process. The system provides operating departments with the ability to enter and update their budget requests for the next fiscal year via terminal. This process eliminates the time consuming batch processing of the budget worksheets which typically occurs. The Budget Office is relieved of the burden of manually assembling the budget and can focus its efforts on the control of the budget.

The system provides for the automatic calculation of fringe benefits as a function of requesting labor budgets thereby eliminating the need to manually calculate and input fringe benefits. In addition, price changes for inflation are computed by the system, thereby insuring consistent application of inflation percentages across organizational boundaries.

To monitor the progress of the development of the budget, departments may query the status of their budget via terminal. Also, the Budget Office may query the status of overall budget requests versus previously determined allocations.

System Overview

The development of next fiscal year's budget by sub-object consists of two processes:

- Allocation of resources to major operating units
- Requests for funds by budget unit heads

Allocation of Resources

At the start of the budget development process, the Budget Office enters allocations previously determined by management. Allocations of current general funds are entered by major operating unit (level 1 organization) and program (level 1 program). In some cases, expenditures are entered in unique categories rather than program, e.g. equipment, sabbatical leave and reserves. The allocations are entered via terminal, and the allocation programs and categories are fixed on the screen. As detail budgets by sub-object are entered into the system, they are posted to the appropriate allocation. The Budget Office and major operating unit can inquire via terminal to display the status of each allocation. Information shown includes current year budget, next year requested, next year allocations, and variances.

Budget Developed by Sub-Object

To assist the budget unit heads in requesting funds for the next fiscal year, a worksheet is generated from the Fund Accounting System showing the current status of the budget by organization, program, fund, and sub-object. Budget unit heads enter requests for the next fiscal year on these worksheets. These data are entered at each site via terminals. The system provides an inquiry capability to display the status of an individual organization budget by program, fund and sub-object. As the budget is modified and changed, additional worksheet reports are provided to input additional requests and to display the current status. To support the analysis of the budget at various management levels within the institution, various hierarchical reports are generated which provide a comparison with the request for the current year budget.

Price Changes

The budget is developed by the major operating units in terms of current year dollars. Once the Budget Office has determined that the budget process is essentially complete, price changes are applied to recognize inflation, etc. Price changes are applied on a percentage basis by major operating unit and sub-object. Once the price changes are applied, they appear in a separate column on the various budget reports. Price changes may be applied more than once; each application will replace previous amounts.

Calculation of Fringe Benefits

As sub-objects for salaries and wages are entered into the system, fringe benefits are calculated and incorporated into the budget. The calculation is based on a percentage which is unique to each salary sub-object. All benefits are recorded to a single sub-object within organization, program and fund.

Interface with the Fund Accounting System (FAS)

Once the budget has been finalized, an interface file to the Fund Accounting System is generated containing budget transactions which are used to record the budget in FAS. Subsequent adjustments to the new current year budget are made directly to FAS.

Fund Accounting System

The Fund Accounting System (FAS) is a comprehensive accounting system which emphasizes financial control and expenditure reporting by organization, program, and account. It is the nucleus of the institution's financial management system and, as such, receives much of its input from "feeder systems. This input may be entered either manually or via computer compatible media from existing automated systems. FAS maintains the official "books" and generates financial statements for both internal management and external reporting. This double entry accounting system keeps a self-balancing set of accounts for major fund groups, including current restricted and unrestricted funds, loan funds, endowment funds, annuity and life income funds, plan funds, and agency funds.

In providing the institutions with financial reports and statements, these reports are based on a flexible fund hierarchy which enables the system to aggregate financial activity from the low level fund, to the fund subgroup, to the high level fund group. The system provides complete grant and project accounting based on the assignment of fund numbers.

FAS operates as an integrated subsystem, thereby eliminating the problems that exist in independently developed software packages—problems including the requirement to manually reenter data because the systems are incompatible; problems associated with the inconsistent reporting of similar data maintained in different systems; or those problems likely to be encountered when reconciling discrepancies among the subsystems. Its major features include on-line inquiry, comprehensive reporting, hierarchical coding schema, budgetary and encumbrance control, complete audit trails, system reconciliation, system tables, single transaction input, one-sided entry and comprehensive transaction validation.

PERRY UNIVAC

P.O. BOX 500
BLUE BELL, PENNSYLVANIA 19424
TELEPHONE (215) 542-4011

MAPPER: AN END-USER/PROGRAMMER PRODUCTIVITY SYSTEM

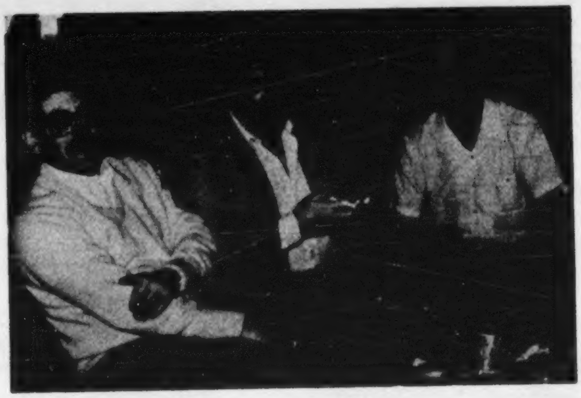
- DO YOU HAVE A BACKLOG OF USER REQUESTS FOR APPLICATIONS?
- ARE YOU SPENDING MORE TIME MAINTAINING EXISTING APPLICATIONS THAN YOU DO DEVELOPING NEW APPLICATIONS?
- DO YOU USUALLY TRY TO GET BY WITH A BATCH IMPLEMENTATION WHEN AN ON-LINE MODE IS PREFERRED?
- ARE YOUR USERS COMPLAINING ABOUT DP SERVICES OR HINTING ABOUT GETTING THEIR OWN COMPUTER?
- WOULD YOU LIKE TO SEE A PROVEN, SUPPORTED SYSTEM WHICH TREATS YOUR APPLICATION — PROVIDING DATA PROCESSING SERVICES TO USERS?

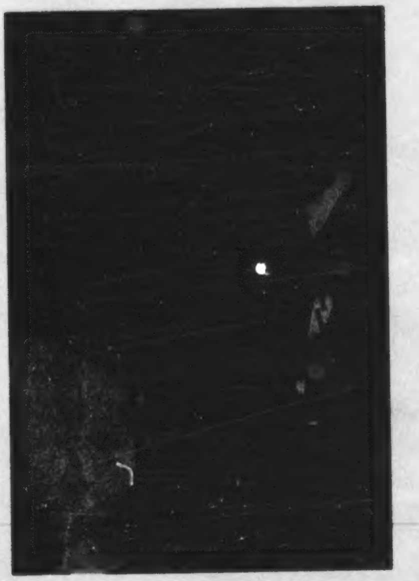
The scarcity of data processing professionals has prompted increased emphasis on the use of non-procedural languages to implement applications. MAPPER, a supported product from Sperry/Univac, combines the ultimate in non-procedural methods and an unusually thorough set of automatic controls to ensure effective and efficient use of the System. In this respect, it is unique in the data processing industry.

BUSINESS AND PLEASURE

Ideas are exchanged as readily during breaks between sessions as they are at formal track presentations. An important part of the Conference experience are the social gatherings—those that are scheduled as official Conference activities as well as those that occur spontaneously as new friendships are formed and old acquaintances are renewed.

REGISTRATION RECEPTION

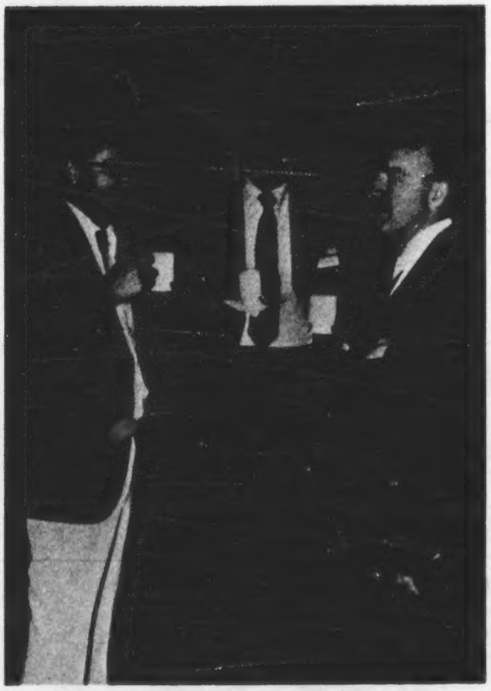




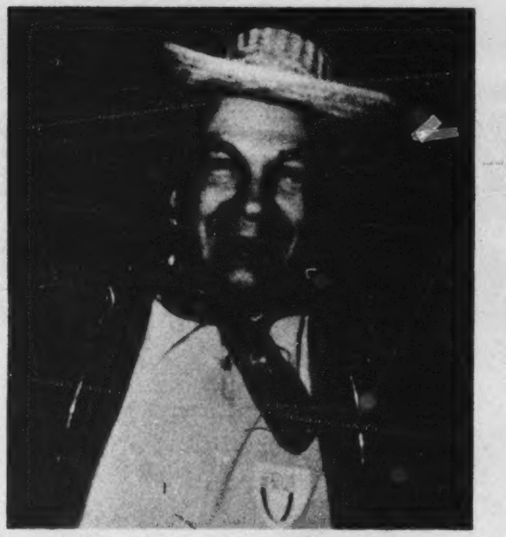
REFRESHMENTS

A special thanks to National Software Enterprises, Inc. for sponsoring the Wednesday morning refreshments.

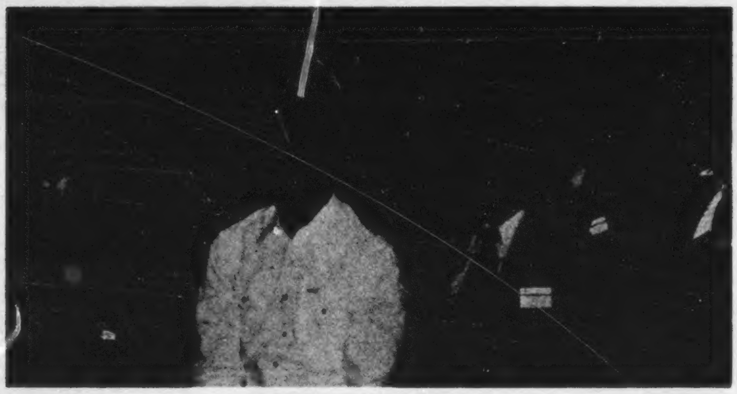
BREAKS

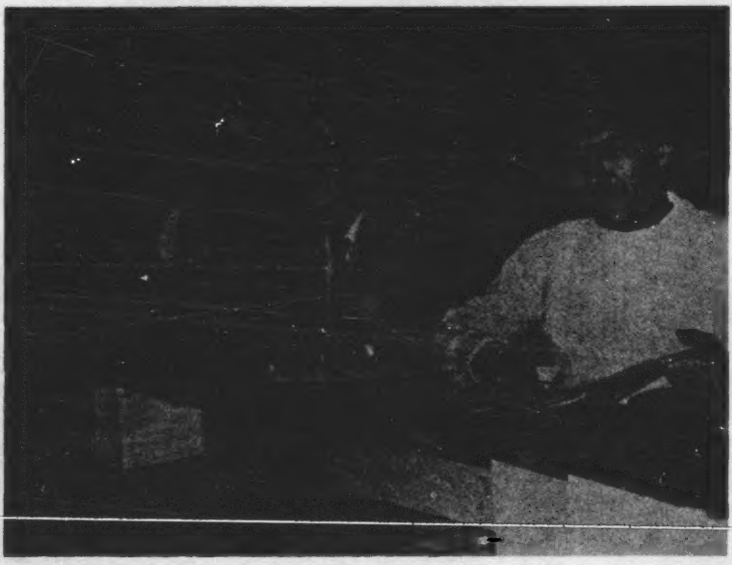


WILD WEST WAHOO



CAUSE 80





CAUSE 80

EDITORIAL
COMMITTEE